# R-20

# SYLLABUS BOOK

for

# B. Tech

## COMPUTER SCIENCE AND ENGINEERING (ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING)

(*Applicable for batches admitted from 2020-21*)

# PRAGATI ENGINEERING COLLEGE

**(AUTONOMOUS)**

Approved by **AICTE**, Permanently Affiliated to **JNTUK, Kakinada**,
Accredited by **NBA**, **NAAC** with **–A**l Grade
Recognized by **UGC 2(f)** and **12(b)** under UGC act, 1956
# 1-378, ADB Road, Surampalem,Near Peddapuram, E.G.Dist, A.P.–533 437

## VISION AND MISSION OF THE INSTITUTE

**VISION:** To emerge as a Premier Institution for Technical Education in the Country through Academic Excellence and to be recognized as a Centre for Excellence in Research & Development, Catering to the needs of our Country.

**MISSION:** To realize a strong Institution by consistently maintaining State-of-art-Infrastructure and building a cohesive, World Class Team and provide need based Technical Education, Research and Development through enhanced Industry Interaction.

## VISION AND MISSION OF THE DEPARTMENT

**VISION**: To emerge as a center of technical expertise in the field of computer science and engineering by producing globally competent professionals with technical & research capabilities, ethical values and team spirit.

**MISSION:**

DM1: To produce competent software professionals.

DM2: To induce application oriented and research capabilities in students for the betterment of society.

DM3: To inculcate ethics and human values in students to adapt to the dynamism in the field of computing technology.

## PROGRAM EDUCATIONAL OBJECTIVES

PEO1: Graduates are prepared to apply analysis, predictions, optimization, decision making and develop skills in order to formulate and solve complex problems using intelligent computing.

PEO2: Graduates are prepared to take up higher studies, research & development and other creative efforts in the area of AI&ML which drives scientific and societal advancement through technological innovation and entrepreneurship.

PEO3: Graduates are prepared to use their skills and abilities in an ethical & professional manner.

## PROGRAM OUTCOMES (POs)

PO1: **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization for the solution of complex engineering problems.

PO2: **Problem Analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: **Design/development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.

PO4: **Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: **Communication:** Communicate effectively on complex engineering activities with the engineering community and with the society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these

to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: **Life-long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

## PROGRAM SPECIFIC OUTCOMES (PSOs)

Engineering Students will be able to:

PSO1: Apply machine learning techniques, software tools to conduct experiments, interpret data and to solve complex problems.

PSO2: Design and development of intelligent automated systems for the benefit of society by the use of AI and ML.

PSO3: Adapt to a rapidly changing environment by learning and employing emerging software tools and technologies in the area of Artificial Intelligence and Machine Learning.

# COURSE STRUCTURE

| Semester- 0 |
|---|
| 3 Weeks Induction Program to be conducted at the beginning of First year |

**Zero Semester**

| Induction program (mandatory) | 3 weeks duration |
|---|---|
| Induction program for students to be offered right at the start of the first year. | • Physical activity<br>• Creative Arts<br>• Universal Human Values<br>• Literary<br>• Proficiency Modules<br>• Lectures by Eminent People<br>• Visits to local Areas<br>• Familiarization to Dept./Branch and Innovations |

When new students enter an institution, they come with diverse thoughts, backgrounds and preparations. It is important to help them adjust to the new environment and inculcate in them the ethos of the institution with a sense of larger purpose. Precious little is done by most of the institutions, except for an orientation program lasting a couple of days. We propose a 3-week long induction program for the UG students entering the institution, right at the start. Normal classes start only after the induction program is over. Its purpose is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature.2 The time during the Induction Program is also used to rectify some critical lacunas, for example, English background, for those students who have deficiency in it. The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

| I Year I Semester | | | | | | | |
|---|---|---|---|---|---|---|---|
| S.No | Category | Course Code | Course Title | Hours per Week | | | Credits |
| | | | | L | T | P | C |
| 1 | HSC | 20HE1T01 | Professional Communicative English | 3 | 0 | 0 | 3 |
| 2 | BSC | 20BM1T01 | Differential Equations and Numerical Methods | 3 | 0 | 0 | 3 |
| 3 | BSC | 20BP1T02 | Applied Chemistry | 3 | 0 | 0 | 3 |
| 4 | ESC | 20CS1T01 | Programming for Problem Solving using C | 3 | 0 | 0 | 3 |
| 5 | ESC | 20IT1L01 | Computer Engineering Workshop | 1 | 0 | 4 | 3 |
| 6 | HSC | 20HE1L01 | Professional Communicative English Laboratory | 0 | 0 | 3 | 1.5 |
| 7 | BSC | 20BP1L02 | Applied Chemistry Laboratory | 0 | 0 | 3 | 1.5 |
| 8 | ESC | 20CS1L01 | Programming for Problem Solving using C Laboratory | 0 | 0 | 3 | 1.5 |
| 9 | MC | 20BE1T01 | Environmental Studies | 2 | 0 | 0 | 0 |
| Total Credits | | | | | | | 19.5 |

| I Year II Semester | | | | | | | |
|---|---|---|---|---|---|---|---|
| S.No | Category | Course Code | Course Title | Hours per Week | | | Credits |
| | | | | L | T | P | C |
| 1 | BSC | 20BM2T02 | Linear Algebra and Partial Differential Equations | 3 | 0 | 0 | 3 |
| 2 | BSC | 20BC2T02 | Applied Physics | 3 | 0 | 0 | 3 |
| 3 | ESC | 20EC2T02 | Digital Logic Design | 3 | 0 | 0 | 3 |
| 4 | ESC | 20CS2T03 | Python Programming | 3 | 0 | 0 | 3 |
| 5 | ESC | 20IT2T01 | Data Structures | 3 | 0 | 0 | 3 |
| 6 | BSC | 20BC2L02 | Applied Physics Laboratory | 0 | 0 | 3 | 1.5 |
| 7 | ESC | 20CS2L03 | Python Programming Laboratory | 0 | 0 | 3 | 1.5 |
| 8 | ESC | 20IT2L02 | Data Structures Laboratory | 0 | 0 | 3 | 1.5 |
| 9 | MC | 20HM2T05 | Constitution of India | 2 | 0 | 0 | 0 |
| Total Credits | | | | | | | 19.5 |

| II Year I Semester | | | | | | | |
|---|---|---|---|---|---|---|---|
| S.No | Category | Course Code | Course Title | Hours per Week | | | Credits |
| | | | | L | T | P | C |
| 1 | BSC | 20BM3T03 | Transforms and Vector Calculus | 3 | 0 | 0 | 3 |
| 2 | PCC | 20CS3T04 | Advanced Data Structures through C | 3 | 0 | 0 | 3 |
| 3 | PCC | 20AI3T01 | Introduction to Artificial Intelligence | 3 | 0 | 0 | 3 |
| 4 | PCC | 20IT3T02 | Database Management Systems | 3 | 0 | 0 | 3 |
| 5 | PCC | 20IT3T03 | Mathematical Foundations of Computer Science | 3 | 0 | 0 | 3 |
| 6 | PCC | 20CS3L04 | Advanced Data Structures through C Laboratory | 0 | 0 | 3 | 1.5 |
| 7 | PCC | 20AI3L01 | Introduction to Artificial Intelligence through LISP / PROLOG Laboratory | 0 | 0 | 3 | 1.5 |
| 8 | PCC | 20IT3L04 | Database Management Systems Laboratory | 0 | 0 | 3 | 1.5 |
| 9 | SOC | 20AM3S01 | Mobile App Development through Android | 0 | 0 | 4 | 2 |
| 10 | MC | 20HM4T06 | Essence of Indian Traditional Knowledge | 2 | 0 | 0 | 0 |
| **Total Credits** | | | | | | | **21.5** |

| II Year II Semester | | | | | | | |
|---|---|---|---|---|---|---|---|
| S.No | Category | Course Code | Course Title | Hours per Week | | | Credits |
| | | | | L | T | P | C |
| 1 | BSC | 20BM4T05 | Probability and Statistics | 3 | 0 | 0 | 3 |
| 2 | ESC | 20EC4T12 | Computer Organization | 3 | 0 | 0 | 3 |
| 3 | PCC | 20AM4T01 | Data Mining | 3 | 0 | 0 | 3 |
| 4 | ESC | 20CS4T07 | Java Programming | 3 | 0 | 0 | 3 |
| 5 | HSC | 20HM4T01 | Managerial Economics and Financial Analysis | 3 | 0 | 0 | 3 |
| 6 | PCC | 20CS4L06 | R Programming Laboratory | 0 | 0 | 3 | 1.5 |
| 7 | PCC | 20AM4L01 | Data Mining using Python Laboratory | 0 | 0 | 3 | 1.5 |
| 8 | ESC | 20CS4L07 | Java Programming Laboratory | 0 | 0 | 3 | 1.5 |
| 9 | SOC | 20AI4S01 | **Skill Oriented Course – I** Applications of Python – Numpy & Pandas | 0 | 0 | 4 | 2 |
| **Total Credits** | | | | | | | **21.5** |
| **Internship 2 Months ( Mandatory) during summer vacation** | | | | | | | |

| III Year I Semester | | | | | | | |
|---|---|---|---|---|---|---|---|
| **S.No** | **Category** | **Course Code** | **Course Title** | **Hours per Week** | | | **Credits** |
| | | | | **L** | **T** | **P** | **C** |
| 1 | PCC | 20IT5T05 | Automata Theory & Compiler Design | 3 | 0 | 0 | 3 |
| 2 | PCC | 20IT5T04 | Operating Systems | 3 | 0 | 0 | 3 |
| 3 | PCC | 20AM5T02 | Machine Learning | 3 | 0 | 0 | 3 |
| 4 | OEC | 20CE5T01<br>20EE5T13<br>20ME5T29<br>20HM5T03 | **Open Elective – I**<br>1. Surveying<br>2. Renewable Energy Engineering<br>3. Optimizing Techniques<br>4. Entrepreneurship | 3 | 0 | 0 | 3 |
| 5 | PCC | 20CS5T05<br>20AI5T02<br>20DS5T10<br>20IT5T07 | **Professional Elective – I**<br>1. Software Engineering<br>2. Computer Vision<br>3. Data Visualization Techniques<br>4. DevOps | 3 | 0 | 0 | 3 |
| 6 | PCC | 20AI5L02 | Operating Systems & Compiler Design Laboratory using C | 0 | 0 | 3 | 1.5 |
| 7 | PCC | 20AM5L02 | Machine Learning Laboratory using Python | 0 | 0 | 3 | 1.5 |
| 8 | SOC | 20IT5S06 | **Skill Oriented Course – III**<br>Continuous Integration and Continuous Delivery using DevOps | 0 | 0 | 4 | 2 |
| 9 | HSC | 20HE5T02 | Employability Skills – I | 2 | 0 | 0 | 2 |
| 10 | #PROJ | 20AM5I01 | **Summer Internship 2 Months (Mandatory) after second year (to be evaluated during V Semester)** | 0 | 0 | 0 | 1.5 |
| 11 | PROJ | 20AM5P01 | **Community Service Project** | 0 | 0 | 0 | 4 |
| **Total Credits** | | | | | | | **25.5** |
| **Internship 2 Months (Mandatory) during summer vacation** | | | | | | | |

| III Year II Semester | | | | | | | |
|---|---|---|---|---|---|---|---|
| **S.No** | **Category** | **Course Code** | **Course Title** | **Hours per Week** | | | **Credits** |
| | | | | **L** | **T** | **P** | **C** |
| 1 | PCC | 20CS6T08 | Computer Networks | 3 | 0 | 0 | 3 |
| 2 | PCC | 20AM6T04 | Deep Learning | 3 | 0 | 0 | 3 |
| 3 | PCC | 20CS6T09 | Design and Analysis of Algorithms | 3 | 0 | 0 | 3 |
| 4 | OEC | 20CE6T36<br>20EE6T19<br>20ME6T25<br>20EC6T26 | **Open Elective – II**<br>1. Disaster Management<br>2. Fundamentals of Electric Vehicles<br>3. Introduction to Automobile Engineering<br>4. Sensors and Transducers | 3 | 0 | 0 | 3 |
| 5 | PCC | 20CS6T12<br>20CS6T13<br>20AM6T05<br>20CS6T17 | **Professional Elective – II**<br>1. Software Project Management<br>2. Distributed Systems<br>3. Game Theory<br>4. Network Programming | 3 | 0 | 0 | 3 |
| 6 | PCC | 20CS6L09 | Computer Networks Laboratory using C | 0 | 0 | 3 | 1.5 |
| 7 | PCC | 20AM6L03 | Algorithms for Efficient Coding Laboratory using C | 0 | 0 | 3 | 1.5 |
| 8 | PCC | 20AM6L04 | Deep Learning with Tensorflow Laboratory | 0 | 0 | 3 | 1.5 |
| 9 | SOC | 20HE6S01 | Soft Skills and Interpersonal Communication. | 1 | 0 | 2 | 2 |
| 10 | HSC | 20HM6T03 | Employability Skills – II | 2 | 0 | 0 | 0 |
| **Total Credits** | | | | | | | **21.5** |
| **Internship 2 Months (Mandatory) during summer vacation** | | | | | | | |

| IV Year I Semester | | | | | | | |
|---|---|---|---|---|---|---|---|
| **S.No** | **Category** | **Course Code** | **Course Title** | **Hours per Week** | | | **Credits** |
| | | | | **L** | **T** | **P** | **C** |
| 1 | PCC | 20AM7T06<br>20AI7T04<br>20IT7T16<br>20AI7T05 | **Professional Elective – III**<br>1. Reinforcement Learning<br>2. Soft Computing<br>3. Block Chain Technologies<br>4. Speech Processing | 3 | 0 | 0 | 3 |
| 2 | PCC | 20CS7T12<br>20DS7T02<br>20DS7T08<br>20AM7T07 | **Professional Elective – IV**<br>1. Cloud Computing<br>2. Big Data Analytics<br>3. NOSQL Databases<br>4. Video Analytics | 3 | 0 | 0 | 3 |
| 3 | PCC | 20AM7T08<br>20AI7T06<br>20CS7T16<br>20AM7T09 | **Professional Elective – V**<br>1. Recommender Systems<br>2. AI Chatbots<br>3. Object Oriented Analysis and Design<br>4. Semantic Web | 3 | 0 | 0 | 3 |
| 4 | OEC | 20CE7T11<br>20EE7T29<br>20EC7T40<br>20HM7T09 | **Open Elective – III**<br>1. Highway Engineering<br>2. Battery Management Systems and Charging Stations<br>3. Industrial Electronics<br>4. Organizational Behavior | 3 | 0 | 0 | 3 |
| 5 | OEC | 20CE7T13<br>20EE7T29<br>20EC7T41<br>20HM7T04 | **Open Elective – IV**<br>1. Water resource Engineering<br>2. Smart Grid Technologies<br>3. Biomedical Instrumentation<br>4. Marketing Management | 3 | 0 | 0 | 3 |
| 6 | HSC | 20HM7T11 | Universal Human Values 2: Understanding Harmony | 3 | 0 | 0 | 3 |
| 7 | SOC | 20AM7S05<br>20CS7S07 | 1. Machine Learning with Go (Infosys Spring Board)<br>2. MEAN Stack Technologies – Module II – MongoDB, Express.js, Angular JS Node.js, and AJAX | 0 | 0 | 4 | 2 |
| 8 | #PROJ | 20AM7I02 | **Summer Internship 2 Months (Mandatory) after second year (to be evaluated during VII Semeter)** | 0 | 0 | 4 | 3 |
| **Total Credits** | | | | | | | 23 |
| **Internship 2 Months (Mandatory) during summer vacation** | | | | | | | |

| IV B. Tech –II Semester | | | | | | |
|---|---|---|---|---|---|---|
| S.No | Course Code | Course Title | Hours per week | | | Credits |
| | | | L | T | P | C |
| 1 | 20AMS8P01 | Major Project Work, Seminar, Internship | - | - | - | 08 |
| Total credits | | | | | | 08 |

L – Lecture T- Tutorial P – Practical C – Credits

# Professional Communicative English

**Common to CE, EEE, ME, ECE, CSE, CSE (AI&ML), CSE(AI), CSE (DS), IT**

| | | | |
|---|---|---|---|
| **Course Category** | Humanities and Social Sciences | **Course Code** | 20HE1T01 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OUTCOMES** | | **BTL** |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | |
| **CO1** | Emphasizes that the ultimate aim of Education is to enhance wisdom and inspires the readers to serve their nation with their self-enrichment. | K2 |
| **CO2** | Enables the learners to promote peaceful co-existence and universal harmony in society and empowers them to initiate innovation. | K2 |
| **CO3** | Imparts the students to manage different cultural shock due to globalization and develop multiculturalism to appreciate diverse cultures and motivate them to contribute to their nation. | K3 |
| **CO4** | Arouses the thought of life to lead in the right path by recognizing the importance of work besides enhancing their LSRW skills. | K2 |
| **CO5** | Inspires the learners at the advancement of software by the eminent personalities and motivates the readers to think and tap their innate talents. | K2 |

**Note:** K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

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

| COURSE CONTENT | |
|---|---|
| UNIT I | 1. _The Greatest Resource- Education' from Professional Communicative English.<br>Objective: Schumacher describes the education system by saying that it was mere training, something more than knowledge of facts.<br>Outcome: Underscores that the ultimate aim of Education is to enhance wisdom.<br>2. 'War' from _Panorama: A Course on Reading'<br>Objective: To develop extensive reading skill and comprehension for pleasure and profit.<br>Outcome: Acquisition of LSRW skills |
| UNIT II | 1. ' A Dilemma' from Professional Communicative English<br>Objective: The lesson centres on the pros and cons of the development of science and technology.<br>Outcome: Enables the students to promote peaceful co-existence and universal harmony among people in society.<br>2. 'The Verger' from _Panorama: A Course on Reading'<br>Objective: To develop extensive reading skill and comprehension for pleasure and profit.<br>Outcome: Acquisition of LSRW skills |
| UNIT III | 1. 'Cultural Shock': Adjustments to new Cultural Environments from Professional Communicative English.<br>Objective: Depicts of the symptoms of Cultural Shock and the aftermath consequences<br>Outcome: Enables the students to manage different cultural shocks due to globalization.<br>2. 'The Scarecrow' from Panorama: A Course on Reading<br>Objective: To develop extensive reading skill and comprehension for pleasure and profit.<br>Outcome: Acquisition of LSRW skills |
| UNIT IV | 1. _The Secret of Work‘ from Professional Communicative English.<br>Objective: Portrays the ways of living life in its real sense.<br>Outcome: Arouses the thoughtto lead life in a right path by recognizing the importance of work.<br>2. 'A Village Lost to the Nation' from Panorama: A Course on Reading |

| | |
|---|---|
| | Objective: To develop extensive reading skill and comprehension for pleasure and profit.<br>Outcome: Acquisition of LSRW skills |
| **UNIT V** | 1. *' The Chief Software Architect' from Professional Communicative English.*<br>Objective: Supports the developments of technology for the betterment of human life.<br>Outcome: Pupil gets inspired by eminent personalities who toiled for the present-day advancement of software development.<br><br>2. *'Martin Luther King and Africa' from Panorama: A Course on Reading*<br>Objective: To develop extensive reading skill and comprehension for pleasure and profit.<br>Outcome: Acquisition of LSRW skills |

| **TEXT BOOKS** | |
|---|---|
| **1.** | **DETAILED TEXTBOOK:**<br>• **PROFESSIONAL COMMUNICATIVE ENGLISH** *Published by Maruthi Publishers.* |
| **2.** | **NON-DETAILED TEXTBOOK:**<br>• ***PANORAMA: A COURSE ON READING****, Published by Oxford University Press India*<br>The course content, along with the study material, is divided into six units. |

# Differential Equations and Numerical Methods

**Common to CE, EEE, ME, ECE, CSE, CSE (AI&ML), CSE(AI), CSE (DS), IT**

| | | | |
|---|---|---|---|
| **Course Category** | Basic Sciences | **Course Code** | 20BM1T01 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | Differentiation, Integration | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | The course is designed to equip the students with the necessary mathematical skills and techniques that are essential for an engineering course. |
| **2** | The skills derived from the course will help the student form a necessary base to develop analytic and design concepts. |

| **COURSE OUTCOMES** | | **BTL** |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | |
| **CO1** | Solve first order differential equations and its applications | K3 |
| **CO2** | Solve the linear differential equations with constant coefficients by appropriate method | K3 |
| **CO3** | Apply Newton, Gauss and Lagrange interpolation formulae to find interpolating polynomials for the given data. | K3 |
| **CO4** | Find the approximate roots of transcendental equations by using different numerical methods | K2 |
| **CO5** | Solve initial value problems by using different numerical schemes | K3 |

**Note:** K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

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

| COURSE CONTENT | |
|---|---|
| **UNIT I** | **Differential equations of first order and first degree** Linear – Bernoulli – Exact – Reducible to exact. **Applications:** Newton's Law of cooling – Law of natural growth and decay – Orthogonal trajectories. |
| **UNIT II** | **Linear differential equations of higher order** Non-homogeneous equations of higher order with constant coefficients with non-homogeneous form $e^{ax}$, $\sin ax$, $\cos ax$ polynomials in $x^n, e^{ax}V(x), x^mV(x)$ - Method of Variation of parameters. |
| **UNIT III** | **Interpolation** Introduction– Errors in polynomial interpolation – Finite differences – Forward differences– Backward differences –Central differences –properties – Differences of a polynomial- Newton's formulae for interpolation –Gauss formulae for interpolation- Interpolation with unequal intervals: Lagrange's interpolation formula. |
| **UNIT IV** | **Solution of Algebraic and Transcendental Equations** Introduction- Bisection method – Method of false position – Iteration method – Newton-Raphson method (One variable). |
| **UNIT V** | **Solution of Ordinary Differential equations** Solution of ordinary differential equations by Taylor's series-Picard's method of successive approximations-Euler's method – Modified Euler's method - Runge-Kutta method (second and fourth order). |

| TEXT BOOKS | |
|---|---|
| **1.** | **B.S.Grewal**, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers. |
| **2.** | **Erwin Kreyszig**, Advanced Engineering Mathematics, 10th Edition, Wiley-India |
| **REFERENCE BOOKS** | |
| **1.** | **Micheael Greenberg**, Advanced Engineering Mathematics, 9th edition, Pearson edn |
| **2.** | **Dean G. Duffy**, Advanced engineering mathematics with MATLAB, CRC Press |
| **3.** | **Peter O'neil**, Advanced Engineering Mathematics, Cengage Learning. |
| **4.** | **Srimanta Pal, Subodh C.Bhunia**, Engineering Mathematics, Oxford University Press. |
| **5.** | **T.K.V. Iyengar et. al.,** Engineering Mathematics Volume I & III S Chand Publications. |
| **WEB RESOURCES** | |

| | |
|---|---|
| **1.** | **UNIT I: Differential equations of first order and first degree**<br>https://en.wikipedia.org/wiki/Differential_equation<br>http://um.mendelu.cz/maw-html/index.php?lang=en&form=ode<br>https://www.khanacademy.org/math/differential-equations/first-order-differential-equations |
| **2.** | **UNIT II: Linear differential equations of higher order**<br>https://en.wikipedia.org/wiki/Differential_equation<br>http://um.mendelu.cz/maw-html/index.php?lang=en&form=ode<br>https://nptel.ac.in/courses/122107037/20 |
| **3.** | **UNIT III: Interpolation**<br>https://en.wikibooks.org/wiki/Introduction_to_Numerical_Methods/Interpolation |
| **4.** | **UNIT IV: Solution of Algebraic and Transcendental Equations**<br>https://en.wikibooks.org/wiki/Numerical_Methods/Equation_Solving<br>https://www.slideshare.net/100005232690054/algebraic-and-transcendental-equations |
| **5.** | **UNIT V: Solution of Ordinary Differential Equations**<br>https://nptel.ac.in/courses/111107063/<br>https://www.facweb.iitkgp.ac.in/~rajas/cgen/page/nptlcrs |

# Applied Chemistry

**Common to CE, EEE, ME, ECE, CSE, CSE (AI&ML), CSE(AI), CSE (DS), IT**

| | | | |
|---|---|---|---|
| **Course Category** | Basic Sciences | **Course Code** | 20BC2T02 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | Intermediate Chemistry | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To learn about Electrochemical cells, Batteries and Fuel cells. |
| **2** | To learn about non conventional energy sources. |
| **3** | To study about Nano materials, Super conductors and their preparation, applications and also about principles of green chemistry and green engineering applications. |
| **4** | To know about Polymers, Plastics and Elastomers. |
| **5** | To Understand the principles of different analytical instruments and their applications. |

| **COURSE OUTCOMES** | | **BTL** |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | |
| **CO1** | To compare different types of batteries and explain the merits of fuel cell. | K2 |
| **CO2** | List out different renewable sources of energy. | K3 |
| **CO3** | To explain the Green methods of Synthesis and applications of Green technologies and also Band theory applications. | K3 |
| **CO4** | Analyze the importance of Polymers in engineering applications. | K2 |
| **CO5** | To Distinguish between Rotaxane and Catenane molecular machines | K4 |

**Note:** K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

| **Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO1 0** | **PO1 1** | **PO1 2** | **PSO 1** | **PSO 2** | **PSO 3** |
| **CO1** | 3 | 1 | 2 | 2 | 2 | - | 2 | - | - | - | 2 | - | 1 | - | **1** |
| **CO2** | 2 | 2 | 1 | - | - | 1 | 1 | - | - | - | 1 | - | - | - | - |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO3** | 1 | 1 | - | 1 | 2 | - | - | - | - | - | - | 1 | - | **1** | - |
| **CO4** | 2 | 2 | - | 1 | - | - | 1 | - | - | - | - | 1 | - | - | - |
| **CO5** | **1** | 1 | 1 | - | - | - | 1 | - | - | - | 2 | 1 | 1 | - | - |

| **COURSE CONTENT** | |
|---|---|
| **UNIT I** | **ELECTROCHEMICAL ENERGY SYSTEMS**<br>Electrode Potential, Nernst Equation, EMF of the cell, Types of Electrodes - Hydrogen and Calomel Electrode, Electrochemical Cell, Galvanic Cell vs Electrolytic Cell, Concentration Cells, Types of Ion Selective Electrodes- Glass Membrane Electro<br>Batteries- Characteristics, Classification and Important Applications. Classical batteries- Dry/Lechlanche cell, Modern batteries- Zinc air, Lithium cells : Li -MnO2 cell.<br>Fuel cells- Introduction, H2-O2 fuel cell, Advantages of fuel cells. |
| **UNIT II** | **ENERGY SOURCES AND APPLICATIONS**<br>Introduction- Sources of renewable energy<br>**Solar energy** – Introduction- Photo voltaic cell/ Solar cell – Construction and Working, Applications of Solar energy. Photo Galvanic Cells, Electrochemical Sensors.<br>**Non Conventional Energy Sources:** Hydropower, Geo Thermal Power, Tidal Power, Ocean Thermal Energy Conversion (OTEC). |
| **UNIT III** | **MATERIAL SCIENCE AND ENGINEERING**<br>**III-A: Nanomaterials:** Introduction , Preparation of Carbon Nano Tubes(CNTs) by Arc discharge and Chemical Vapor Deposition Methods.<br>Fullerenes : Preparation, Properties and Applications;<br>Chemical Synthesis of Nanomaterials : Sol-gel method, Applications of Nano Materials in Wastewater treatment and Medicine.<br>**III-B: Green Chemistry:** Introduction, Principles of Green Chemistry and Engineering Applications with a ***case study***<br>**Band Theory of Solids:** Introduction –Explanation of Conductors, Semiconductors and Insulators by Band Theory. Super conductors: Types-Preparation, Properties and Applications**.** |
| **UNIT IV** | **POLYMER CHEMISTRY**<br>**Polymers**: Introduction, Functionality of monomers, Chain ( Addition) Polymerization, Step(Condensation) Polymerization, Co-Ordination Polymerization, Co - Polymerization with examples and Mechanism. Conducting polymers : Mechanism of Conduction in Poly acetylene, Poly aniline and their Applications.<br>**Plastics**: Thermoplastics and Thermo Setting resins; Preparation, Properties and Applications of Bakelite, Urea- formaldehyde Resin, Nylon – 6,6.<br>**Elastomers**: ***Vulcanization of rubber***, Preparation, Properties and Applications of Buna-S and Buna – N. |

| | |
|---|---|
| **UNIT V** | **Instrumental Methods & Molecular Machines and Switches**<br>A) Spectroscopic Techniques: Electromagnetic Spectrum- Introduction, Absorption of radiation: Beer-Lambert's law. Principles of UV-Visible and IR Spectroscopic techniques and their Applications.<br>B) Molecular Machines: Rotaxanes and Catenanes as artificial Molecular Machines.<br>Molecular Switches: Introduction, Cyclodextrin based Switches. |

| | |
|---|---|
| **TEXT BOOKS** | |
| **1.** | P.C. Jain and M. Jain, Engineering Chemistry, 15/e, Dhanapat Rai & Sons, Delhi (2014). |
| **2.** | Engineering Chemistry by Shikha Agarwal: Cambridge University Press,2019 edition . |
| **REFERENCE BOOKS** | |
| **1.** | Sashi Chawla, A Textbook of Engineering Chemistry, Dhanapath Rai and sons, (2003) |
| **2.** | S.S. Dara, A Textbook of Engineering Chemistry, S.Chand& Co, (2010) |
| **3.** | N. Krishna Murthy and Anuradha, A text book of Engineering Chemistry, Murthy Publications (2014) |
| **WEB RESOURCES** | |
| **1.** | **Electrochemical Energy systems**<br>https://en.wikipedia.org/wiki/Electrochemical_cell |
| **2.** | **Energy Sources and Applications**<br>https://en.wikipedia.org/wiki/Hydropower |
| **3.** | **Material Science and Engineering**<br>https://en.wikipedia.org/wiki/Nanomaterials |
| **4.** | **Polymer Chemistry**<br>https://en.wikipedia.org/wiki/Polymer_chemistry |
| **5.** | **Instrumental Methods & Molecular Machines and Switches**<br>https://en.wikipedia.org/wiki/Spectroscopy |

| | |
|---|---|
| | https://youtu.be/DDLljK1ODeg |
| **4.** | https://study.com/academy/lesson/the-de-broglie-hypothesis-definition-significance.html<br>https://nptel.ac.in/courses/115/101/115101107/<br>https://nptel.ac.in/courses/115/105/115105122/ |
| **5.** | https://www.electronics-tutorials.ws/diode/diode_1.html<br>https://nptel.ac.in/courses/115/105/115105099/<br>https://nptel.ac.in/courses/108/108/108108122/ |

# Programming for Problem solving using C

**Common to CE, EEE, ME, ECE, CSE, CSE (AI&ML), CSE(AI), CSE (DS), IT**

| | | | |
|---|---|---|---|
| **Course Category** | Engineering Sciences | **Course Code** | 20CS1T01 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To learn about the computer systems, computing environments, developing of a computer program and Structure of a C Program. |
| **2** | To gain knowledge of the operators, selection, control statements and repetition in C. |
| **3** | To learn about the design concepts of arrays, strings, enumerated structure and union types and their usage. |
| **4** | To assimilate about pointers, dynamic memory allocation and know the significance of Preprocessor. |
| **5** | To assimilate about File I/O and significance of functions. |

| **COURSE OUTCOMES** | | **BTL** |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | |
| **CO1** | Apply the fundamentals of C Programming for Problem solving. | K3 |
| **CO2** | Identify the appropriate Decision statement and Loops for a given Problem. | K2 |
| **CO3** | Make use of Arrays and Strings to solve the problems in C. | K3 |
| **CO4** | design and implement programs to analyze the different pointer applications | K3 |
| **CO5** | Develop solutions for problems using Files and Functions. | K3 |

**Note:** K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

| Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PS O1** | **PS O2** | **PS O3** |
| **CO1** | 3 | 3 | 3 | 3 | 1 | - | - | - | - | - | - | - | 1 | 1 | - |
| **CO2** | 3 | 3 | 3 | 3 | 1 | - | - | - | - | - | - | - | 1 | 1 | - |
| **CO3** | 3 | 3 | 3 | 2 | 1 | - | - | - | - | - | - | - | 2 | 1 | - |
| **CO4** | 2 | 3 | 3 | 3 | 1 | - | - | - | - | - | - | - | 2 | 2 | - |
| **CO5** | 3 | 3 | 3 | 3 | 1 | - | - | - | - | - | - | - | 2 | 2 | - |

| **COURSE CONTENT** | |
|---|---|
| **UNIT I** | **Introduction to Computers**: Creating and running Programs, Computer Numbering System, Storing Integers, Storing Real Numbers<br>**Introduction to the C Language:** Background, C Programs, Identifiers, Types, Variable, Constants, Input/output, Programming Examples, Scope, Storage Classes and Type Qualifiers.<br>**Structure of a C Program:** Expressions Precedence and Associativity, Side Effects, Evaluating Expressions, Type Conversion Statements, Simple Programs, Command Line Arguments. |
| **UNIT II** | **Bitwise Operators**: Exact Size Integer Types, Logical Bitwise Operators, Shift Operators.<br>**Selection & Making Decisions**: Logical Data and Operators, Two Way Selection, Multiway Selection, More Standard Functions.<br>**Repetition:** Concept of Loop, Pretest and Post-test Loops, Initialization and Updating, Event and Counter Controlled Loops, Loops in C, Other Statements Related to Looping, Looping Applications, Programming Examples. |
| **UNIT III** | **Arrays:** Concepts, Using Array in C, Array Application, Two Dimensional Arrays, Multidimensional Arrays, Programming Example – Calculate Averages<br>**Strings:** String Concepts, C String, String Input / Output Functions, Arrays of Strings, String Manipulation Functions String/ Data Conversion, A Programming Example – Morse Code Enumerated, Structure, and Union: The Type Definition (Type def), Enumerated Types, Structure, Unions, and Programming Application. |
| **UNIT IV** | **Pointers:** Introduction, Pointers to pointers, Compatibility, L value and R value<br>Pointer Applications: Arrays, and Pointers, Pointer Arithmetic and Arrays, Memory Allocation Function, Array of Pointers, Programming Application.<br>Processor Commands: Processor Commands. |
| **UNIT V** | **Functions:** Designing, Structured Programs, Function in C, User Defined Functions, Inter-Function Communication, Standard Functions, Passing Array to Functions, Passing Pointers to Functions, Recursion<br>**Text Input / Output:** Files, Streams, Standard Library Input / Output Functions, Formatting Input / Output Functions, Character Input / Output Functions<br>Binary Input / Output: Text versus Binary Streams, Standard Library, Functions for Files, Converting File Type. |

| | |
|---|---|
| **TEXT BOOKS** | |
| **1.** | Programming for Problem Solving, Beerhouse A. Forouzan, Richard F.Gilberg, CENGAGE. |
| **2.** | The C Programming Language, Brian W.Kernighan, Dennis M. Ritchie, 2e, Pearson. |
| **REFERENCE BOOKS** | |
| **1.** | Computer Fundamentals and Programming, Sumithabha Das, Mc Graw Hill. |
| **2.** | Programming in C, Ashok N. Kamthane, Amit Kamthane, Pearson. |
| **3.** | Computer Fundamentals and Programming in C, Pradip Dey, Manas Ghosh, OXFORD. |
| **WEB RESOURCES** | |
| **1.** | http://nptel.ac.in/courses/106104128/ |
| **2.** | http://students.iitk.ac.in/programmingclub/course/#notes |
| **3.** | http://c-faq.com/~scs/cclass/cclass.html |
| **4.** | http://www.youtube.com/watch?v=b00HsZvg-V0&feature=relmfu |
| **5.** | http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-087-practical-programming-in-c-january-iap-2010/ |

# Computer Engineering Workshop

**Common to CSE, CSE(AI&ML), CSE(AI), CSE(DS), IT**

| | | | |
|---|---|---|---|
| **Course Category** | Engineering Sciences | **Course Code** | 20IT1L01 |
| **Course Type** | Laboratory | **L-T-P-C** | 1-0-4-3 |
| **Prerequisites** | | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 15<br>35<br>50 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | PC Hardware: Identification of basic peripherals, Assembling a PC, Installation of system software like MS Windows, device drivers, etc. Troubleshooting of PC Hardware and Software issues. |
| **2** | Internet & World Wide Web: Different ways of hooking the PC on to the internet from home and workplace and effectively usage of the internet, web browsers, email, newsgroups and discussion forums. Awareness of cyber hygiene (protecting the personal computer from getting infected with the viruses), worms and other cyber attacks. |
| **3** | Productivity Tools: Understanding and practical approach of professional word documents, excel spread sheets, power point presentations and personal web sites using the Microsoft suite office tools. |

| **COURSE OUTCOMES** | | |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | **BTL** |
| **CO1** | Identify, assemble and update the components of a computer | K2 |
| **CO2** | Configure, evaluate and select hardware platforms for the implementation and execution of computer applications, services and systems | K3 |
| **CO3** | Make use of tools for converting pdf to word and vice versa | K2 |
| **CO4** | Develop presentation, documents and small applications using productivity tools such as word processor, presentation tools, spreadsheets, HTML, LaTex | K3 |

*k1- Remembering, k2- Understanding, k3- Applying, k4- Analyzing, k5- Evaluating, k6- Creating

| Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
| CO1 | 3 | 2 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 1 |
| CO2 | 3 | 2 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 |
| CO3 | 2 | 2 | 2 | 1 | 2 | - | - | - | - | - | - | - | - | 1 | 1 |
| CO4 | 2 | 2 | 2 | 1 | 2 | - | - | - | - | - | - | - | 1 | 2 | 2 |

| COURSE CONTENT | |
|---|---|
| Task 1 | Identification of the peripherals of a computer - Prepare a report containing the block diagram of the computer along with the configuration of each component and its functionality. Describe about various I/O Devices and its usage. |
| Task 2 | Practicing disassembling and assembling components of a PC |
| Task 3 | Installation of Device Drivers, MS Windows, Linux Operating systems and Disk Partitioning, dual boating with Windows and Linux |
| Task 4 | Introduction to Memory and Storage Devices, I/O Port, Assemblers, Compilers, Interpreters, Linkers and Loaders. |
| Task 5 | Demonstration of Hardware and Software Troubleshooting |
| Task 6 | Demonstrating Importance of Networking, Transmission Media, Networking Devices- Gateway, Routers, Hub, Bridge, NIC, Bluetooth Technology, Wireless Technology, Modem, DSL, and Dialup Connection. |
| Task 7 | Surfing the Web using Web Browsers, Awareness of various threats on the Internet and its solutions, Search engines and usage of various search engines, Need of anti-virus, Installation of anti-virus, configuring personal firewall and windows update. (Students should get connected to their Local Area Network and access the Internet. In the process they should configure the TCP/IP setting and demonstrate how to access the websites and email. Students customize their web browsers using bookmarks, search toolbars and pop up blockers) |
| **Productivity Tools** | |
| Task 8 | Basic HTML tags, Introduction to HTML5 and its tags, Introduction to CSS3 and its properties. Preparation of a simple website/ homepage, Assignment: Develop your home page using HTML Consisting of your photo, name, address and education details as a table and your skill set as a list. Features to be covered:- Layouts, Inserting text objects, Editing text objects, Inserting Tables, Working with menu objects, Inserting pages, Hyper linking, Renaming, deleting, modifying pages, etc., |

| | |
|---|---|
| **Task 9** | Demonstration and Practice of various features of Microsoft Word Assignment: 1. Create a project certificate. 2. Creating a news letter Features to be covered:-Formatting Fonts, Paragraphs, Text effects, Spacing, Borders and Colors, Header and Footer, Date and Time option, tables, Images, Bullets and Numbering, Table of Content, Newspaper columns, Drawing toolbar and Word Art and Mail Merge in word etc., |
| **Task 10** | Demonstration and Practice of various features Microsoft Excel Assignment:<br>1. Creating a scheduler<br>2. Calculating GPA<br>3. Calculating Total, average of marks in various subjects and ranks of students based on marks Features to be covered:- Format Cells, Summation, auto fill, Formatting Text, Cell Referencing, Formulae in excel, Charts, Renaming and Inserting worksheets, etc., |
| **Task 11** | Demonstration and Practice of various features Microsoft Power Point Features to be covered:- Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Hyperlinks Tables and Charts, Master Layouts, Types of views, Inserting – Background, textures, Design Templates, etc., |
| **Task 12** | Demonstration and Practice of various features LaTeX – document preparation, presentation (Features covered in Task 9 and Task 11 need to be explored in LaTex) |
| **Task 13** | Tools for converting word to pdf and pdf to word |
| **Task 14** | Internet of Things (IoT): IoT fundamentals, applications, protocols, communication models, architecture, IoT devices |

Note: Faculty to consolidate the workshop manuals using the textbook and references

| **REFERENCE BOOKS** | |
|---|---|
| **1** | Computer Fundamentals, Anita Goel, Pearson India Education, 2017 |
| **2** | PC Hardware Trouble Shooting Made Easy, TMH |
| **3** | Introduction to Information Technology, ITL Education Solutions Limited, 2nd Edition, Perason, 2020 |
| **4** | Upgrading and Repairing PCs, 18th Edition, Scott Mueller, QUE, Pearson, 2008 |
| **5** | LaTeX Companion – Leslie Lamport, PHI/Pearson |
| **6** | Introducing HTML5, Bruce Lawson, Remy Sharp, 2nd Edition, Pearson, 2012 |
| **7** | Teach yourself HTML in 24 hours, By Techmedia |
| **8** | HTML 5 and CSS 3.0 to the Real World by Alexis Goldstein, Sitepoint publication |
| **9** | Internet of Things, Technologies, Applications, Challenges and Solutions, B K Tripathy, J Anuradha, CRC Press |

| | |
|---|---|
| **10** | Comdex Information Technology Course Tool Kit, Vikas Gupta, Wiley Dreamtech |
| **11** | IT Essentials PC Hardware and Software Companion Guide Third Edition by David Anfinson and Ken Quamme, CISCO Press, Pearson Education |
| **12** | Essential Computer and IT Fundamentals for Engineering and Science Students, Dr. N.B. Venkateswarlu, S. Chand Publishers |

# Professional Communicative English Laboratory

**Common to CE, EEE, ME, ECE, CSE, CSE (AI&ML), CSE(AI), CSE (DS), IT**

| | | | |
|---|---|---|---|
| **Course Category** | Humanities and Social Sciences | **Course Code** | 20HE1L01 |
| **Course Type** | Laboratory | **L-T-P-C** | 0-0-3-1.5 |
| **Prerequisites** | | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 15<br>35<br>50 |

| **COURSE OUTCOMES** | | **BTL** |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | |
| **CO1** | Understand different speech sounds and maintain proper pronunciation and rhythm in day to day conversations. | K2 |
| **CO2** | Interpret and respond appropriately in various day to day contexts and improves technics in group discussions. | K5 |
| **CO3** | Develop the required communication skills to deliver effective presentations and interviews with clarity and impact. | K6 |

**Note:** K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

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

| COURSE CONTENT | |
|---|---|
| **UNIT I** | Introduction, Consonant Sounds, Vowel Sounds |
| **UNIT II** | Rhythm and Pronunciation , Weak/strong and contrasted forms, Practice of Rhythm |
| **UNIT III** | Dialogues |
| **UNIT IV** | Group Discussions |
| **UNIT V** | Presentations & Public Speaking |
| **UNIT VI** | Interviews |

**PRESCRIBED LAB MANUAL FOR SEMESTER I:**
_**STRENGTHEN YOUR STEPS**: A Multimodal Course in Communication Skills‘ Published by Maruthi Publications.
**OBJECTIVES:** To enable the students to learn demonstratively the communication skills of listening, speaking, reading and writing.

**OUTCOME:** A study of the communicative items in the laboratory will help the students become successful in the competitive world.

The course content, along with the study material, is divided into six units.

# Applied Chemistry Laboratory

**Common to CE, EEE, ME, ECE, CSE, CSE (AI&ML), CSE(AI), CSE (DS), IT**

| | | | |
|---|---|---|---|
| **Course Category** | Basic Sciences | **Course Code** | 20BC2L02 |
| **Course Type** | Laboratory | **L-T-P-C** | 0-0-3-1.5 |
| **Prerequisites** | Basic Chemistry | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 15<br>35<br>50 |

| **COURSE OUTCOMES** | | **BTL** |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | |
| **CO1** | Estimate the given amount of dissolved compounds in a solution by using volumetric analysis and preparation of polymers and nano particles | K3 |
| **CO2** | Determine the concentration of different metal ions present in water by complexometric titrations. | K2 |
| **CO3** | Evaluate the accurate value of $P^H$ and conductivity of given solutions and to estimate the viscosity and surface tension of given solutions. | K5 |

**Note:** K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 1 | 2 | - | - | - | - | - | - | - | - | - | - | - | - |
| **CO2** | 2 | 1 | - | 1 | - | - | - | - | - | - | - | - | - | - | - |
| **CO3** | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - |

| COURSE CONTENT<br>**Any 10 of the following listed 13 experiments**<br>Introduction to chemistry laboratory – Molarity, Normality, Primary, Secondary standard solutions, Volumetric titrations, Quantitative analysis | |
|---|---|
| **1.** | Estimation of HCI using standard $Na_2CO_3$ solutions |
| **2.** | Determination of alkalinity of a sample containing $Na_2CO_3$ and NaOH |
| **3.** | Estimation of $KmnO_4$ using standard Oxalic acid solution |
| **4.** | Estimation of Ferrous iron using standard $K_2Cr_2O_7$ solution |
| **5.** | Determination of Temporary and permanent Hardness of water using standard EDTA solution |
| **6.** | Determination of % moisture content in a coal sample |
| **7.** | Determination of $Mg^{2+}$ present in an antacid |
| **8.** | Estimation of HCl using standard NaOH Solution by Conductometric titration |
| **9.** | Estimation of Vitamin – C |
| **10.** | Preparation of Phenol – Formaldehyde Resin |
| **11.** | Determination of viscosity of a liquid |
| **12.** | Determination of surface tension of a liquid |
| **13.** | Preparation of Nano particles.(Cu/Zn) |

| **TEXT BOOKS** | |
|---|---|
| **1.** | Mendham J, Denney RC, Barnes JD, Thosmas M and Sivasankar B Vogel‘s Quantitative Chemical Analysis 6/e, Pearson publishers (2000) |
| **2.** | N.K Bhasin and Sudha Rani Laboratory Manual on Engineering Chemistry 3/e, Dhanpat Rai Publishing Company (2007) |
| **REFERENCE BOOKS** | |
| **1.** | Vogel‘s Textbook of Quantitative chemical analysis, J. Mendham et.al. |
| **2.** | College designed manual |
| **WEB RESOURCES** | |
| **1.** | www.bsauniv.ac.in/UploadImages/Downloads/Estimation%20of%20Hardness |
| **2.** | https://pubs.acs.org/doi/abs/10.1021/i560133a023 |

# PRAGATI ENGINEERING COLLEGE
## (Autonomous)
### B.Tech
### Computer Science and Engineering (Artificial Intelligence & Machine Learning)

**R-20**

## Programming for Problem solving using C Laboratory

**Common to CE, EEE, ME, ECE, CSE, CSE (AI&ML), CSE(AI), CSE (DS), IT**

| | | | |
|---|---|---|---|
| **Course Category** | Engineering Sciences | **Course Code** | 20CS1L01 |
| **Course Type** | Laboratory | **L-T-P-C** | 0-0-3-1.5 |
| **Prerequisites** | | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 15<br>35<br>50 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | Apply the principles of C language in problem solving. |
| **2** | To design flowcharts, algorithms and knowing how to debug programs. |
| **3** | To design & develop of C programs using arrays, strings pointers & functions. |
| **4** | To review the file operations, preprocessor commands. |

| **COURSE OUTCOMES** | | **BTL** |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | |
| **CO1** | Knowledge on various concepts of a C language. | K3 |
| **CO2** | Draw flowcharts and write algorithms. | K3 |
| **CO3** | Design and development of C problem solving skills. | K3 |

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

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

| **COURSE CONTENT** | |
|---|---|
| **1.** | **Exercise 1:**<br>1. Write a C program to print a block F using hash (#), where the F has a height of six characters and width of five and four characters.<br>2. Write a C program to compute the perimeter and area of a rectangle with a height of 7 inches and width of 5 inches. |

| | |
|---|---|
| | 3. Write a C program to display multiple variables. |
| **2.** | **Exercise 2:**<br>1. Write a C program to calculate the distance between the two points.<br>2. Write a C program that accepts 4 integers p, q, r, s from the user where r and s are positive and p is even. If q is greater than r and s is greater than p and if the sum of r and s is greater than the sum of p and q print "Correct values", otherwise print "Wrong values". |
| **3.** | **Exercise 3:**<br>1. Write a C program to convert a string to a long integer.<br>2. Write a program in C which is a Menu-Driven Program to compute the area of the various geometrical shape.<br>3. Write a C program to calculate the factorial of a given number. |
| **4.** | **Exercise 4:**<br>1. Write a program in C to display the n terms of even natural number and their sum.<br>2. Write a program in C to display the n terms of harmonic series and their sum. 1 + 1/2 + 1/3 + 1/4 + 1/5 ... 1/n terms.<br>3. Write a C program to check whether a given number is an Armstrong number or not. |
| **5.** | **Exercise 5:**<br>1. Write a program in C to print all unique elements in an array.<br>2. Write a program in C to separate odd and even integers in separate arrays.<br>3. Write a program in C to sort elements of array in ascending order. |
| **6.** | **Exercise 6:**<br>1. Write a program in C for multiplication of two square Matrices.<br>2. Write a program in C to find transpose of a given matrix. |
| **7.** | **Exercise 7:**<br>1. Write a program in C to search an element in a row wise and column wise sorted matrix.<br>2. Write a program in C to print individual characters of string in reverse order. |
| **8.** | **Exercise 8:**<br>1. Write a program in C to compare two strings without using string library functions.<br>2. Write a program in C to copy one string to another string. |
| **9.** | **Exercise 9:**<br>1. Write a C Program to Store Information Using Structures with Dynamically Memory Allocation<br>2. Write a program in C to demonstrate how to handle the pointers in the program. |
| **10.** | **Exercise 10:**<br>1. Write a program in C to demonstrate the use of & (address of) and *(value at address) operator.<br>2.Write a program in C to add two numbers using pointers |
| **11.** | **Exercise 11:**<br>1. Write a program in C to add numbers using call by reference.<br>2. Write a program in C to find the largest element using Dynamic Memory Allocation. |

| | |
|---|---|
| **12.** | **Exercise 12:**<br>1. Write a program in C to swap elements using call by reference.<br>2. Write a program in C to count the number of vowels and consonants in a string using a pointer. |
| **13.** | **Exercise 13:**<br>1. Write a program in C to show how a function returning pointer.<br>2. Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using malloc( ) function. |
| **14.** | **Exercise 14:**<br>1. Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using calloc( ) function. Understand the difference between the above two programs<br>2. Write a program in C to convert decimal number to binary number using the function. |
| **15.** | **Exercise 15:**<br>1. Write a program in C to check whether a number is a prime number or not using the function.<br>2. Write a program in C to get the largest element of an array using the function. |
| **16.** | **Exercise 16:**<br>1. Write a program in C to append multiple lines at the end of a text file.<br>2. Write a program in C to copy a file in another name.<br>3. Write a program in C to remove a file from the disk. |

# Environmental Science

## Common to CE, ME, ECE, CSE, CSE (AI&ML), CSE(AI), CSE (DS), IT

| | | | |
|---|---|---|---|
| **Course Category** | Mandatory Course | **Course Code** | 20BE1T01 |
| **Course Type** | Theory | **L-T-P-C** | 2-0-0-0 |
| **Prerequisites** | Basic Knowledge in Environment and protection. | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 0<br>0<br>0 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To make the students to get awareness on environment, to understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day to day activities of human life to save earth from the inventions by the engineers. |

| **COURSE OUTCOMES** | | **BTL** |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | |
| **CO1** | Gain a higher level of personal involvement and interest in understanding and solving environmental problems. | K2 |
| **CO2** | Comprehend environmental problems from multiple perspectives with emphasis on human modern lifestyles and developmental activities | K2 |
| **CO3** | Demonstrate knowledge relating to the biological systems involved in the major global environmental problems of the 21st century | K2 |
| **CO4** | Recognize the interconnectedness of human dependence on the earth‘s ecosystems | K2 |
| **CO5** | Influence their society in proper utilization of goods and services. | K2 |

**Note:** K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

| Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
| CO 1 | 1 | - | 1 | - | - | 1 | 2 | - | - | - | 1 | - | - | - | - |
| CO 2 | - | 1 | - | - | - | - | 1 | - | - | - | - | - | - | - | - |
| CO 3 | - | - | - | - | 2 | - | 1 | - | - | - | - | - | - | - | - |
| CO 4 | - | - | - | - | 1 | 1 | 3 | - | - | - | - | - | - | - | - |
| CO 5 | - | - | - | - | - | - | 3 | 1 | - | - | - | - | - | - | - |

| COURSE CONTENT | |
|---|---|
| UNIT I | **Multidisciplinary nature of Environmental Studies**<br>Definition, Scope and Importance-International Efforts & Indian Environmentalists<br>**Natural Resources**<br>Forest resources : deforestation – Mining, dams and other effects on forest and tribal people.<br>Water resources :Use and over utilization of surface and groundwater.<br>Food resources: World food problems, effects of modern agriculture, fertilizer-pesticide problems.<br>Energy resources: renewable and nonrenewable energy sources.<br>Role of an individual in conservation of natural resources.Equitable use of resources for sustainable lifestyles. |
| UNIT II | **Ecosystems, Biodiversity and its conservation**<br>Definition of Ecosystem and its structure, Functions<br>Biodiversity Definition-Value of biodiversity, India as a mega-diversity nation, Threats to biodiversity, Conservation of biodiversity, Endangered and endemic species of India. |
| UNIT III | **Environmental Pollution and Solid Waste Management**<br>Definition, Cause, Effects of Air pollution, Water pollution, Noise pollution, Radioactive pollution, Role of an individual in prevention of pollution.<br>Solid Waste Management: Sources, effects and control measures of urban and industrial waste, e-waste management |
| UNIT IV | **Social Issues and the Environment**<br>Air (Prevention and Control of Pollution) Act. –Water (Prevention and control of Pollution) Act-Issues involved in enforcement of environmental legislation, Rain water harvesting, |

| | |
|---|---|
| | Global Environmental challenges-case studies |
| **UNIT V** | **Human population and the Environment**<br>Population growth, Women and child welfare, Role of Information technology in environment and human health. Impact Assessment and its significances, stages of EIA<br>Field work:<br>A mini project related to Environmental issues / to visit a local polluted site (Submission of project by every student) |

| | |
|---|---|
| **TEXT BOOKS** | |
| **1.** | Environmental Studies for undergraduate courses by ErachBharucha,UGC. |
| **2.** | A Textbook of Environmental Studies by Dr.S.AzeemUnnisa,Acadamic publishing company. |
| **3.** | Environmental Studies by P.N. Palanisamy, P. Manikandan, A. Geetha, and K. Manjula Rani; Pearson Education, Chennai |
| **REFERENCE BOOKS** | |
| **1.** | Text Book of Environmental Studies by Deeshita Dave & P. UdayaBhaskar, Cengage learning. |
| **2.** | Glimpses of Environment by K.V.S.G. Murali Krishna Published by Environmental Protection Society, Kakinada, A.P. |
| **3.** | Environmental Studies by Benny Joseph, Tata McGraw Hill Co, New Delhi |
| **4.** | Environmental Studies by PiyushMalaviya, Pratibha Singh, Anoopsingh: Acme Learning, New Delhi. |
| **5.** | An Introduction to Environmental Pollution by Dr.B.k.Sharma AND Dr.(Miss)H.kaur,Goel publishing House ,a unit of Krishna Prakasham Media (p) LH,Meerut –India |
| **WEB RESOURCES** | |
| **1.** | **UNIT-1: MULTI DISPLINARY NATURE OF ENVIRONMENT and NATURAL RESOURCES**<br>http://www.defra.gov.uk/environment/climatechange<br>https://www.climatesolutions.org<br>https://en.wikibooks.org/wiki/Ecology/Ecosystems |
| **2.** | **UNIT-2:ECOSYSTEM, BIODIVERSITY AND ITS CONSERVATION**<br>http://conbio.net/vl/ and www.biodiversitya-z.org/content/biodiversity |
| **3.** | **UNIT-3: ENVIRONMENTAL POLLUTION**<br>https://www.omicsonline.org/environment-pollution-climate-change.php and<br>https://www.britannica.com/technology/solid-waste-management |

| | |
|---|---|
| **4.** | **UNIT-4: SOCIAL ISSUES AND THE ENVIRONMENT**<br>http://www.publichealthnotes.com/solid-waste-management/ |
| **5.** | **UNIT-5: HUMANPOPULATION AND THE NVIRONMENT**http://www.ecoindia.com/education/water-conservation.html<br>https://thewaterproject.org/water_conservation\<br>https://legalcareerpath.com/what-is-environmental-law/ |

# Linear Algebra and Partial Differential Equations

**Common to CE, EEE, ME, ECE, CSE, CSE (AI&ML), CSE(AI), CSE (DS), IT**

| | | | |
|---|---|---|---|
| **Course Category** | Basic Sciences | **Course Code** | 20BM2T02 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | Basics of Matrices, Differentiation, Integration | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | The course is designed to equip the students with the necessary mathematical skills and techniques that are essential for an engineering course. |
| **2** | The skills derived from the course will help the student form a necessary base to develop analytic and design concepts. |

| **COURSE OUTCOMES** | | **BTL** |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | |
| **CO1** | Solve systems of linear equations, determine the rank, find the eigenvalues and eigenvectors, diagonalization of a matrix. | K3 |
| **CO2** | Identify special properties of a matrix, such as positive definite, etc., and use this information to facilitate the calculation of matrix characteristics. | K2 |
| **CO3** | Find areas and volumes using double and triple integrals | K2 |
| **CO4** | Find partial derivatives of multivariable functions and apply them to find extreme values of a function. | K3 |
| **CO5** | Apply a range of techniques to find solutions of standard PDEs | K3 |

**Note:** K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

| | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO1 0** | **PO1 1** | **PO1 2** | **PSO 1** | **PSO 2** | **PSO 3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | - |
| **CO2** | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | - |
| **CO3** | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | - |
| **CO4** | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | - |
| **CO5** | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | - |

| COURSE CONTENT | |
|---|---|
| **UNIT I** | **Solving system of linear equations, Eigen Values and Eigen vectors**<br>Rank of a matrix by echelon form and normal form – Solving system of homogeneous and non-homogeneous linear equations – Gauss elimination method, Gauss Jacobi and Gauss Seidel for solving system of equations – Eigenvalues and Eigen vectors and their properties. |
| **UNIT II** | **Cayley-Hamilton Theorem and Quadratic forms**<br>Cayley-Hamilton theorem (without proof) – Finding inverse and powers of a matrix by Cayley-Hamilton theorem – Quadratic forms-Reduction to canonical form by congruent transformations- nature of the quadratic form - reduction of quadratic form to canonical form by orthogonal transformation. |
| **UNIT III** | **Multiple integrals**<br>Multiple integrals: Double and triple integrals – Change of variables -Polar coordinates - Cylindrical coordinates– Change of order of integration.<br>**Applications:** Finding Areas and Volumes. |
| **UNIT IV** | **Partial differentiation**<br>Introduction – Homogeneous function – Euler‘s theorem – Total derivative – Chain rule – Generalized Mean value theorem for single variable (without proof) – Taylor‘s and Maclaurin‘s series expansion of functions of two variables – Jacobian – Functional dependence.<br>**Applications:** Maxima and Minima of functions of two variables without constraints and Lagrange‘s method (with constraints). |
| **UNIT V** | **Partial Differential Equations and Applications**<br>Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions –solutions of first order linear (Lagrange) equation and nonlinear (standard types) equations.<br>**Applications:** One dimensional wave and heat equations. |

| TEXT BOOKS | |
|---|---|
| **1.** | **B.S.Grewal**, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers. |
| **2.** | **Erwin Kreyszig**, Advanced Engineering Mathematics, 10th Edition, Wiley-India |
| **REFERENCE BOOKS** | |
| **1.** | **Micheael Greenberg**, Advanced Engineering Mathematics, 9th edition, Pearson edn |
| **2.** | **Dean G. Duffy**, Advanced engineering mathematics with MATLAB, CRC Press |

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|---|---|
| **3.** | **Peter O'neil**, Advanced Engineering Mathematics, Cengage Learning. |
| **4.** | **Srimanta Pal, Subodh C.Bhunia**, Engineering Mathematics, Oxford University Press. |
| **5.** | **T.K.V. Iyengar et. al.,** Engineering Mathematics Volume I & III S Chand Publications. |
| **6.** | **T. Amarnath,** An Elementary Course in Partial Differential Equations, Narosa Publications |


**WEB RESOURCES**

| | |
|---|---|
| **1.** | **UNIT I: Solving system of linear equations, Eigen Values and Eigen vectors**<br>https://en.wikipedia.org/wiki/System_of_linear_equations<br>https://en.wikipedia.org/wiki/Eigenvalues_and_eigenvectors |
| **2.** | **UNIT II: Cayley-Hamilton Theorem and Quadratic forms**<br>https://www.math.hmc.edu/calculus/tutorials/eigenstuff/<br>https://en.wikipedia.org/wiki/Quadratic_form |
| **3.** | **UNIT III: Multiple Integrals**<br>https://en.wikipedia.org/wiki/Multiple_integral<br>http://tutorial.math.lamar.edu/Classes/CalcIII/MultipleIntegralsIntro.aspx |
| **4.** | **UNIT IV: Partial Differentiation**<br>https://en.wikipedia.org/wiki/Partial_derivative<br>https://www.whitman.edu/mathematics/calculus_online/section14.03.html |
| **5.** | **UNIT V:Partial Differential Equations and Applications**<br>https://en.wikipedia.org/wiki/Partial_differential_equation |

# Applied Physics

## Common to CE, EEE, ME, ECE, CSE, CSE (AI&ML), CSE(AI), CSE (DS), IT

| | | | |
|---|---|---|---|
| **Course Category** | Basic Sciences | **Course Code** | 20BP2T02 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | Intermediate Physics | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | Impart Knowledge of Physical Optics phenomena like Interference and Diffraction required to design instruments with higher resolution. |
| **2** | Impart the knowledge of Lasers, Optical Fibers and their implications in optical communications. |
| **3** | To explain the significant concepts of dielectric and magnetic materials that leads to potential applications in emerging micro devices. |
| **4** | To explain the concepts of Quantum Mechanics and free electron theories for study of metals and semiconductors. |
| **5** | Understand the formation of bands in Semiconductors and their working mechanism for their utility in Engineering applications |

| **COURSE OUTCOMES** | | **BTL** |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | |
| **CO1** | Analyze the optical applications using the concepts of Interference and diffraction. | K4 |
| **CO2** | Apply the basics of Laser Mechanism and fiber optics for the communications systems. | K3 |
| **CO3** | Apply the basics of phenomenon related to dielectric materials and Magnetic Materials to study their dependence on temperature and frequency response. | K3 |
| **CO4** | Understand the concepts of quantum mechanics for calculation of free quantum particle energies and phenomenon of electrical & thermal conductivities to sub microscopic particles. | K2 |
| **CO5** | Understand the Band formation, electrical conductivities in semiconductors and study the types of semiconductors using Hall Effect. | K2 |

**Note:** K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

| **Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO10** | **PO11** | **PO12** | **PSO 1** | **PSO 2** | **PSO 3** |
| **CO1** | 2 | 2 | - | 1 | 1 | - | - | - | - | - | - | - | - | - | - |
| **CO2** | 2 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| **CO3** | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **CO4** | 2 | 2 | - | 1 | - | - | - | - | - | - | - | - | - | - | - |
| **CO5** | 2 | 2 | 2 | - | - | - | - | - | - | - | - | 2 | - | - | - |

| **COURSE CONTENT** | |
|---|---|
| **UNIT I** | **WAVEOPTICS**<br>**INTERFERENCE**<br>Introduction-Principle of Superposition – Coherent Sources – Interference in parallel thin film(reflection geometry)- Newton‘s rings, Determination of Wavelength and Refractive Index & Applications.<br><br>**DIFFRACTION**<br>Introduction-Types of diffraction-Fraunhoffer diffraction due to single slit, Double slit, N Slits (Qualitative)-Rayleigh criterion of resolution and Resolving power of grating (Qualitative). |
| **UNIT II** | **LASERS**<br>Introduction-Characteristics–Spontaneous and Stimulated emission of radiation – population inversion - Pumping Schemes - Ruby laser – Helium Neon laser – Applications<br>**FIBER OPTICS:**<br>Introduction- Structure & Principle of Optical Fiber-Numerical Aperture and Acceptance Angle-classification of Optical fibers based on Refractive Index Profile and Modes- Block Diagram of optical fiber communication system- Advantages of Optical fibers- Applications. |
| **UNIT III** | **MAGNETICS PROPERTIES**<br>Introduction-Magnetic dipole moment-Magnetization-Magnetic susceptibility and permeability- Origin of permanent magnetic moment -Classification of Magnetic materials Dia,Para,Ferro,Antiiferro and Ferri Magnetic materials-Weiss Domain Theory(Qualitative Treatment)-Hysteresis-B-H Curve-soft and hard magnetic materials & applications<br>**DIELECTRICS**<br>Introduction - Dielectric polarization– Dielectric Polarizability, Susceptibility and Dielectric |

| | |
|---|---|
| | constant-types of polarizations- Electronic Ionic and Orientation polarizations (qualitative) – Lorentz Internal field – Claussius-Mossoti equation -Applications of dielectrics. |
| **UNIT IV** | **QUANTUM MECHANICS**<br>Introduction – Matter waves – de Broglie's hypothesis–Interpretation of wave function – Schrödinger Time Independent and Time Dependent wave equations – Particle in a potential box<br>**FREE ELECTRON THEORY**<br>Classical Free Electron Theory(Qualitative with discussions of merit and demerits)-Quantum Free Electron Theory-Equation of conductivity based on quantum free electron theory-Fermi Dirac Distribution-Density of States-Fermi Energy |
| **UNIT V** | **BANDTHEORYOFSOLIDS**<br>Bloch's Theorem(Qualitative)-Kronig Penny Model(Qualitative)-E vs K diagram-V vs K diagram, Effective mass of electron-Classification of Crystalline Solids-Concept of hole<br>**SEMICONDUCTOR PHYSICS**<br>Introduction–Intrinsic Semi conductors - density of charge carriers- Electrical conductivity – Fermi level – extrinsic semiconductors - p-type & n-type - Density of charge carriers-Drift and Diffusion currents-Einstein's Equation -Hall effect - Applications of Hall effect |

| **TEXT BOOKS** | |
|---|---|
| **1.** | Engineering Physics by M.N.Avadhanalu,P.G.Kshirsagar & T V S Arun Murty,S Chand Pubication,11th Edition 2019 |
| **2.** | -Engineering Physics by M.R.Srinivasan, New Age international publishers |
| **3.** | Engineering Physics by P.K Palanisamy,Sci Tech Publication |
| **REFERENCE BOOKS** | |
| **1.** | Kettles Introduction to Solid state Physics-Charles Kittel,Wiley India Edition |
| **2.** | Solid State Physics ,AJ Dekker, I Edition,Macmillan Publishers India Private Limited |
| **3.** | -Solid State Physics by SO Pilai., - New age International Publishers |
| **4.** | Engineering Physics by DK Bhattacharya and Poonam Tandon,Oxford Press(2018) |
| **WEB RESOURCES** | |
| **1.** | https://nptel.ac.in/courses/122/107/122107035/#<br>https://nptel.ac.in/courses/122/107/122107035/# |
| **2.** | https://pragatiengg.org/pluginfile.php/29143/mod_folder/content/0/UNIT%20IV%20LAS |
| | ERS%20.pptx?forcedownload=1 https://nptel.ac.in/courses/104/104/104104085/ |

| | |
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| | https://nptel.ac.in/courses/115/107/115107095/ |
| **3.** | https://nptel.ac.in/courses/113/104/113104090/<br>https://youtu.be/DDLljK1ODeg |
| **4.** | https://study.com/academy/lesson/the-de-broglie-hypothesis-definition-significance.html<br>https://nptel.ac.in/courses/115/101/115101107/ https://nptel.ac.in/courses/115/105/115105122/ |
| **5.** | https://www.electronics-tutorials.ws/diode/diode_1.html<br>https://nptel.ac.in/courses/115/105/115105099/<br>https://nptel.ac.in/courses/108/108/108108122/ |

# Digital Logic Design

## Common to CSE (AI&ML), CSE(AI), CSE(DS)

| | | | |
|---|---|---|---|
| **Course Category** | Engineering Sciences | **Course Code** | 20EC2T03 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To study the basic philosophy underlying the various number systems, negative number representation, binary arithmetic, theory of Boolean algebra and map method for minimization of switching functions. |
| **2** | To introduce the basic tools for design of combinational and sequential digital logic. |
| **3** | To learn simple digital circuits in preparation for computer engineering. |

| **COURSE OUTCOMES** | | **BTL** |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | |
| **CO1** | Define different number systems, binary addition and subtraction, 2‘s complement representation and operations with this representation. | K1 |
| **CO2** | Understand the different switching algebra theorems and apply them for logic functions and Karnaugh map for a few variables and perform an algorithmic reduction of logic functions. | K2 |
| **CO3** | Design various logic gates starting from simple ordinary gates to complex programmable logic devices & arrays. | K4 |
| **CO4** | Design various sequential circuits starting from flip-flop and conversion of flipflops. | K4 |
| **CO5** | Design registers, shift registers, synchronous counters and ring counters. | K4 |

**Note:** K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

| Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** | **PSO 3** |
| **CO 1** | 3 | 2 | 2 | - | - | - | - | - | - | 1 | - | - | 1 | - | - |
| **CO 2** | 2 | 2 | 2 | - | - | - | - | - | - | 1 | - | - | 1 | - | - |
| **CO 3** | 1 | 2 | 2 | - | - | - | - | - | - | 1 | - | - | - | 2 | - |
| **CO 4** | 2 | 1 | 2 | - | - | - | - | - | - | 1 | - | - | 1 | - | - |
| **CO 5** | 2 | 2 | 3 | - | - | - | - | - | - | 1 | - | - | - | 1 | - |

| **COURSE CONTENT** | |
|---|---|
| **UNIT I** | Digital Systems and Binary NumbersDigital Systems, Binary Numbers, Octal and Hexadecimal Numbers, Complements of Numbers,Signed Binary Numbers, Arithmetic addition and subtraction, 4-bit codes: BCD, EXCESS 3,alphanumeric codes, 9‘s complement, 2421, etc. |
| **UNIT II** | Concept of Boolean algebra: Basic Theorems and Properties of Boolean algebra, Boolean Functions, Canonical and Standard Forms, Minterms and Maxterms. Gate level Minimization Map Method, Three-Variable K-Map, Four Variable K-Maps. Products of Sum Simplification, Sum of Products Simplification, Don‘t – Care Conditions, NAND and NOR Implementation, Exclusive OR Function. |
| **UNIT III** | Combinational Logic: Introduction, Analysis Procedure, Binary Adder–Subtractor, Binary Multiplier, Decoders,Encoders, Multiplexers, Demultiplexers, Priority Encoder, Code Converters, MagnitudeComparator, HDL Models of Combinational Circuits. Realization of Switching Functions Using PROM, PAL and PLA. |
| **UNIT IV** | Synchronous Sequential Logic Introduction to Sequential Circuits, Storage Elements: Latches, Flip-Flops, RS- Latch Using NAND and NOR Gates, Truth Tables. RS, JK, T and D Flip Flops, Truth and Excitation Tables, Conversion of Flip Flops. |
| **UNIT V** | Registers and Counters Registers, Shift Registers, Ripple Counters, Synchronous Counters, Ring Counter, Johnson Counter. |

| | |
|---|---|
| **TEXT BOOKS** | |
| **1.** | Digital Design, 5/e, M.Morris Mano, Michael D Ciletti, PEA. |
| **2.** | Fundamentals of Logic Design, 5/e, Roth, Cengage |
| **REFERENCE BOOKS** | |
| **1.** | Digital Logic and Computer Design, M.Morris Mano, PEA. |
| **2.** | Digital Logic Design, Leach, Malvino, Saha, TMH. |
| **3.** | Modern Digital Electronics, R.P. Jain, TMH. |

# Python Programming

**Common to CSE, CSE (AI&ML), CSE(AI), CSE (DS), IT**

| | | | |
|---|---|---|---|
| **Course Category** | Engineering Sciences | **Course Code** | 20CS2T03 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | | **Internal Assessment Semester End Examination Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To learn about Python programming language syntax, semantics, and the runtime environment. |
| **2** | To be familiarized with universal computer programming concepts like data types, containers. |
| **3** | To be familiarized with general computer programming concepts like conditional execution, loops & functions. |
| **4** | To be familiarized with general coding techniques and object-oriented programming |

| **COURSE OUTCOMES** | | **BTL** |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | |
| **CO1** | Develop essential programming skills in computer programming concepts like data types, containers. | K3 |
| **CO2** | Apply the basics of programming in the Python language. | K3 |
| **CO3** | Solve coding tasks related conditional execution, loops. | K3 |
| **CO4** | Solve coding tasks related to the fundamental notions and techniques used in object- oriented programming. | K3 |
| **CO5** | Make use of Exceptions and GUI interfaces for developing applications | K3 |

**Note:** K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

| Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
| CO1 | 3 | 2 | 1 | 1 | 1 | - | - | - | - | - | - | 1 | 3 | 3 | 2 |
| CO2 | 3 | 2 | 1 | 1 | 1 | - | - | - | - | - | - | 1 | 3 | 3 | 2 |
| CO3 | 3 | 2 | 1 | 1 | 1 | - | - | - | - | - | - | 1 | 3 | 3 | 2 |
| CO4 | 3 | 2 | 2 | 3 | 3 | - | - | - | - | - | - | 1 | 3 | 3 | 2 |
| CO5 | 3 | 2 | 2 | 3 | 3 | - | - | - | - | - | - | 1 | 3 | 3 | 2 |

| COURSE CONTENT | |
|---|---|
| UNIT I | Introduction: Introduction to Python, Program Development Cycle, Input, Processing, and Output, Displaying Output with the Print Function, Comments, Variables, Reading Input from the Keyboard, Performing Calculations, Operators. Type conversions, Expressions, More about Data Output.<br>Data Types, and Expression: Strings Assignment, and Comment, Numeric Data Types and Character Sets, Using functions and Modules.<br>Decision Structures and Boolean Logic: if, if-else, if-elif-else Statements, Nested Decision Structures, Comparing Strings, Logical Operators, Boolean Variables. Repetition Structures: Introduction, while loop, for loop, Calculating a Running Total, Input Validation Loops, Nested Loops. |
| UNIT II | Control Statement: Definite iteration for Loop Formatting Text for output, Selection if and if else Statement, Conditional Iteration The While Loop<br>Strings and Text Files: Accessing Character and Substring in Strings, Data Encryption, Strings and Number Systems, String Methods Text Files. |
| UNIT III | List and Dictionaries: Lists, Defining Simple Functions, Dictionaries<br>Design with Function**:** Functions as Abstraction Mechanisms, Problem Solving with Top Down Design, Design with Recursive Functions, Case Study Gathering Information from a File System, Managing a Program‘s Namespace, Higher Order Function.<br>Modules: Modules, Standard Modules, Packages. |
| UNIT IV | File Operations: Reading config files in python, Writing log files in python, Understanding read functions, read(), readline() and readlines(), Understanding write functions, write() and writelines(), Manipulating file pointer using seek, Programming using file operations<br>Object Oriented Programming**:** Concept of class, object and instances, Constructor, class attributes and destructors, Real time use of class in live projects, Inheritance , overlapping and overloading operators, Adding and retrieving dynamic attributes of classes, Programming using Oops support<br>Design with Classes: Objects and Classes, Data modeling Examples, Case Study An ATM, |

| | |
|---|---|
| | Structuring Classes with Inheritance and Polymorphism. |
| **UNIT V** | Errors and Exceptions: Syntax Errors, Exceptions, Handling Exceptions, Raising Exceptions, User-defined Exceptions, Defining Clean-up Actions, Redefined Clean-up Actions. Graphical User Interfaces: The Behavior of Terminal Based Programs and GUI -Based, Programs, Coding Simple GUI-Based Programs, Other Useful GUI Resources. Programming**:** Introduction to Programming Concepts with Scratch. |

| **TEXT BOOKS** | |
|---|---|
| **1.** | Fundamentals of Python First Programs, Kenneth. A. Lambert, Cengage. |
| **2.** | Python Programming: A Modern Approach, VamsiKurama, Pearson. |
| **REFERENCE BOOKS** | |
| **1.** | Introduction to Python Programming, Gowrishankar.S, Veena A, CRC Press. |
| **2.** | Introduction to Programming Using Python, Y. Daniel Liang, Pearson. |
| **WEB RESOURCES** | |
| **1.** | https://www.tutorialspoint.com/python3/python_tutorial.pdf |

# Data Structures

**Common to CE, EEE, ME, ECE, CSE, CSE (AI&ML), CSE(AI), CSE (DS), IT**

| | | | |
|---|---|---|---|
| **Course Category** | Engineering Sciences | **Course Code** | 20IT2T01 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | Exposure to Programming for Problem Solving using C | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | Introduce the fundamental concept of data structures and abstract data types |
| **2** | Emphasize the importance of data structures in developing and implementing efficient algorithms |
| **3** | Describe how arrays, records, linked structures, stacks, queues, trees, and graphs are represented in memory and used by algorithms |

| **COURSE OUTCOMES** | | **BTL** |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | |
| **CO1** | Summarize the properties, interfaces, and behaviors of basic abstract data types | K2 |
| **CO2** | Discuss the computational efficiency of the principal algorithms for sorting & searching | K2 |
| **CO3** | Use arrays, records, linked structures, stacks, queues, trees, and Graphs in writing programs | K3 |
| **CO4** | Demonstrate different methods for traversing trees | K2 |
| **CO5** | Implement algorithms on Graphs | K3 |

**Note:** K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

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

| COURSE CONTENT | |
|---|---|
| **UNIT I** | **Data Structures** - Definition, Classification of Data Structures, Operations on Data Structures, Abstract Data Type (ADT), Preliminaries of algorithms. Time and Space complexity. Searching - Linear search, Binary search, Fibonacci search.<br>**Sorting**- Insertion sort, Selection sort, Exchange (Bubble sort, quick sort), distribution (radix sort), merging (Merge sort) algorithms. |
| **UNIT II** | **Linked List:** Introduction, Single linked list, Representation of Linked list in memory, Operations on Single Linked list-Insertion, Deletion, Search and Traversal ,Reversing Single Linked list, Applications on Single Linked list- Polynomial Expression Representation, Addition and Multiplication, Sparse Matrix Representation using Linked List, Advantages and Disadvantages of Single Linked list, Double Linked list-Insertion, Deletion, Circular Linked list-Insertion, Deletion. |
| **UNIT III** | **Queues:** Introduction to Queues, Representation of Queues-using Arrays and using Linked list, Implementation of Queues-using Arrays and using Linked list, Application of Queues- Circular Queues, Deques, Priority Queues, Multiple Queues.<br>**Stacks:** Introduction to Stacks, Array Representation of Stacks, Operations on Stacks, Linked list Representation of Stacks, Operations on Linked Stack, Applications-Reversing list, Factorial Calculation, Infix to Postfix Conversion, Evaluating Postfix Expressions. |
| **UNIT IV** | **Trees:** Basic Terminology in Trees, Binary Trees-Properties, Representation of Binary Trees using Arrays and Linked lists. Binary Search Trees- Basic Concepts, BST Operations: Insertion, Deletion, Tree Traversals, Applications-Expression Trees, Heap Sort, Balanced Binary Trees- AVL Trees, Insertion, Deletion and Rotations. |
| **UNIT V** | **Graphs:** Basic Concepts, Representations of Graphs-Adjacency Matrix and using Linked list, Graph Traversals (BFT & DFT), Applications- Minimum Spanning Tree Using Prims & Kruskals Algorithm, Dijkstra's shortest path, Transitive closure, Warshall's Algorithm. |

| TEXT BOOKS | |
|---|---|
| **1.** | Data Structures Using C. 2nd Edition.Reema Thareja, Oxford. |
| **2.** | Data Structures and algorithm analysis in C, 2nded, Mark Allen Weiss. |
| **REFERENCE BOOKS** | |
| **1.** | Fundamentals of Data Structures in C, 2nd Edition, Horowitz, Sahni, Universities Press. |
| **2.** | Data Structures: A PseudoCode Approach, 2/e, Richard F.Gilberg, Behrouz A. Forouzon, Cengage. |
| **3.** | Data Structures with C, Seymour Lipschutz TMH |
| **WEB RESOURCES** | |
| **1.** | http://algs4.cs.princeton.edu/home/ |
| **2.** | https://faculty.washington.edu/jstraub/dsa/Master_2_7a.pdf |

# Applied Physics Laboratory

## Common to CE, EEE, ME, ECE, CSE, CSE (AI&ML), CSE(AI), CSE (DS), IT

| | | | |
|---|---|---|---|
| **Course Category** | Basic Sciences | **Course Code** | 20BP2L02 |
| **Course Type** | Laboratory | **L-T-P-C** | 0-0-3-1.5 |
| **Prerequisites** | Intermediate Physics | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 15<br>35<br>50 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | The student will have exposure to experimental skills which is essential for an Engineering student. |
| **2** | To gain practical knowledge by applying the experimental results and correlate with the theoretical principles. |
| **3** | Apply the Analytical techniques and graphical analysis to the experimental data |

| **COURSE OUTCOMES** | | **BTL** |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | |
| **CO1** | Understand the basics of Interference, Diffraction in Physics using instruments like Spectrometer, Travelling microscope. | K2 |
| **CO2** | Determine the Magnetic and Dielectric constants of materials. | K3 |
| **CO3** | Apply the basics of Current Electricity and Semiconductors in engineering application | K3 |

**Note:** K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

| Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
| CO 1 | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO 2 | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO 3 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - | - |

| COURSE CONTENT<br>(Any 10 of the following listed 15 experiments):<br>8 Regular mode and any two experiments in Virtual mode(Virtual Lab) | |
|---|---|
| 1. | Determination of wavelength of laser Light using diffraction grating. |
| 2. | Determination of wavelength of a light using Diffraction Grating-Normal incidence. |
| 3. | Newton‘s rings – Determination of Radius of Curvature of Plano - Convex Lens. |
| 4. | Determination of thickness of a spacer using wedge film and parallel interference fringes. |
| 5. | Magnetic field along the axis of a current carrying coil – Stewart and Gee‘s apparatus. |
| 6. | Energy Band gap of a Semiconductor p - n junction. |
| 7. | Characteristics of Thermistor – Temperature Coefficients |
| 8. | Determination of dielectric constant by charging and discharging method |
| 9. | Study the variation of B versus H by magnetizing the magnetic material (B-H curve). |
| 10. | Determination of Dispersive power of diffraction grating. |
| 11. | To Study the V-I Characteristics and determine the breakdown voltage of a Zener Diode |
| 12. | Determination of Hall Voltage and Hall coefficients of a given semiconductor using Hall effect. |
| 13. | Determination of Acceleration due to gravity and Radius of gyration Using Compound Pendulum. |

| | |
|---|---|
| **14.** | Determination of Numerical Aperture and acceptance angle of an Optical Fiber |
| **15.** | Estimation of Planck's Constant using Photoelectric Effect. |
| **TEXT BOOKS** | |
| **1.** | College customized manual |
| **WEB RESOURCES** | |
| **1.** | www.vlab.co.in (virtual lab link) |

# PRAGATI ENGINEERING COLLEGE
## (Autonomous)
### B.Tech
### Computer Science and Engineering (Artificial Intelligence & Machine Learning)

**R-20**

# Python Programming Laboratory

**Common to CSE, CSE (AI&ML), CSE(AI), CSE (DS), IT**

| | | | |
|---|---|---|---|
| **Course Category** | Engineering Sciences | **Course Code** | 20CS2L03 |
| **Course Type** | Laboratory | **L-T-P-C** | 0-0-3-1.5 |
| **Prerequisites** | | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 15<br>35<br>50 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To acquire programming skills in core Python and to acquire Object Oriented Skills in Python |
| **2** | To develop the skill of designing Graphical user Interfaces in Python |
| **3** | To develop the ability to write database applications in Python |

| **COURSE OUTCOMES** | | **BTL** |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | |
| **CO1** | Write, Test and Debug Python Programs and Use Conditionals and Loops for Python Programs | K4 |
| **CO2** | Use functions and represent Compound data using Lists, Tuples and Dictionaries | K3 |
| **CO3** | Use various applications using python | K3 |

**Note:** K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

| | **PO1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO1 0** | **PO1 1** | **PO1 2** | **PSO 1** | **PSO 2** | **PSO 3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 1 | 1 | 1 | - | - | - | - | - | - | 2 | 3 | 3 | 2 |
| **CO2** | 3 | 2 | 1 | 1 | 1 | - | - | - | - | - | - | 2 | 3 | 3 | 2 |
| **CO3** | 3 | 2 | 1 | 1 | 1 | - | - | - | - | - | - | 2 | 3 | 3 | 2 |

**COURSE CONTENT**

1) Write a program that asks the user for a weight in kilograms and converts it to pounds. There are 2.2 pounds in a kilogram.
2) Write a program that asks the user to enter three numbers (use three separate input statements). Create variables called total and average that hold the sum and average of the three numbers and print out the values of total and average.
3) Write a program that uses a *for* loop to print the numbers 8, 11, 14, 17, 20, . . . , 83, 86, 89.
4) Write a program that asks the user for their name and how many times to print it. The program should print out the user's name the specified number of times.
5) Use a *for*loop to print a triangle like the one below. Allow the user to specify how high the triangle should be.

```
*
**
***
****
```

6) Generate a random number between 1 and 10. Ask the user to guess the number and print a message based on whether they get it right or not.
7) Write a program that asks the user for two numbers and prints *Close* if the numbers are within .001 of each other and Not close otherwise.
8) Write a program that asks the user to enter a word and prints out whether that word contains any vowels.
9) Write a program that asks the user to enter two strings of the same length. The program should then check to see if the strings are of the same length. If they are not, the program should print an appropriate message and exit. If they are of the same length, the program should alternate the characters of the two strings. For example, if the user enters *abcde*and*ABCDE* the program should print out *AaBbCcDdEe*.
10) Write a program that asks the user for a large integer and inserts commas into it according to the standard American convention for commas in large numbers. For instance, if the user enters 1000000, the output should be1,000,000.
11) In algebraic expressions, the symbol for multiplication is often left out, as in 3x+4y or 3(x+5). Computers prefer those expressions to include the multiplication symbol, like 3*x+4*y or 3*(x+5). Write a program that asks the user for an algebraic expression and

    then inserts multiplication symbols where appropriate.
12) Write a program that generates a list of 20 random numbers between 1 and 100.
    (a) Print the list.
    (b) Print the average of the elements in the list.

(c) Print the largest and smallest values in the list.
(d) Print the second largest and second smallest entries in the list
(e) Print how many even numbers are in the list.

13) Write a program that asks the user for an integer and creates a list that consists of the factors of that integer.
14) Write a program that generates 100 random integers that are either 0 or 1. Then find the longest run of zeros, the largest number of zeros in a row. For instance, the longest run of zeros in [1,0,1,1,0,0,0,0,1,0,0] is 4.
15) Write a program that removes any repeated items from a list so that each item appears at most once. For instance, the list [1,1,2,3,4,3,0,0] would become [1,2,3,4,0].
16) Write a program that asks the user to enter a length in feet. The program should then give the user the option to convert from feet into inches, yards, miles, millimeters, centimeters, meters, or kilometers. Say if the user enters a 1, then the program converts to inches, if they enter a 2, then the program converts to yards, etc. While this can be done with if statements,it is much shorter with lists and it is also easier to add new conversions if you use lists.
17) Write a function called *sum_digits*that is given an integer num and returns the sum of the digits of num.
18) Write a function called *first_diff*that is given two strings and returns the first location in which the strings differ. If the strings are identical, it should return -1.
19) Write a function called *number_of_factors*that takes an integer and returns how many factors the number has.
20) Write a function called *is_sorted*that is given a list and returns True if the list is sorted and False otherwise.
21) Write a function called root that is given a number x and an integer n and returns $x^{1/n}$. In the function definition, set the default value of n to 2.
22) Write a function called primes that is given a number n and returns a list of the first n primes. Let the default value of n be 100.
23) Write a function called merge that takes two already sorted lists of possibly different lengths, and merges them into a single sorted list.
(a) Do this using the sort method. (b) Do this without using the sort method.
24) Write a program that asks the user for a word and finds all the smaller words that can be made from the letters of that word. The number of occurrences of a letter in a smaller word can‘t exceed the number of occurrences of the letter in the user‘s word.
25) Write a program that reads a file consisting of email addresses, each on its own line. Your program should print out a string consisting of those email addresses separated by semicolons.
26) Write a program that reads a list of temperatures from a file called *temps.txt*,

converts those temperatures to Fahrenheit, and writes the results to a file called ftemps.txt.

27) Write a class called Product. The class should have fields called name, amount, and price, holding the product‘s name, the number of items of that product in stock, and the regular price of the product. There should be a method *get_price*that receives the number of items to be bought and returns a the cost of buying that many items, where the regular price is charged for orders of less than 10 items, a 10% discount is applied for orders of between 10 and 99 items, and a 20% discount is applied for orders of 100 or more items. There should also be a method called *make_purchase*that receives the number of items to be bought and decreases amount by that much.
28) Write a class called Time whose only field is a time in seconds. It should have a method called *convert_to_minutes*that returns a string of minutes and seconds formatted as in the following example: if seconds is 230, the method should return '5:50'. It should also have a method called *convert_to_hours*that returns a string of hours, minutes, and seconds formatted analogously to the previous method.
29) Write a class called Converter. The user will pass a length and a unit when declaring an object from the class—for example, c = Converter(9,'inches'). The possible units are inches, feet, yards, miles, kilometers, meters, centimeters, and millimeters. For each of these units there should be a method that returns the length converted into those units. For example, using the Converter object created above, the user could call c.feet() and should get 0.75 as the result.
30) Write a Python class to implement pow(x, n).
31) Write a Python class to reverse a string word by word.
32) Write a program that opens a file dialog that allows you to select a text file. The program then displays the contents of the file in a textbox.
33) Write a program to demonstrate Try/except/else.
34) Write a program to demonstrate try/finally and with/as.

# Data Structures Laboratory

**Common to CSE, CSE(AI&ML), CSE(AI), CSE(DS), IT**

| | | | |
|---|---|---|---|
| **Course Category** | Engineering Sciences | **Course Code** | 20IT2L02 |
| **Course Type** | Laboratory | **L-T-P-C** | 0-0-3-1.5 |
| **Prerequisites** | Programming for Problem Solving using C | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 15<br>35<br>50 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | Demonstrate the different data structures implementation. |

| **COURSE OUTCOMES** | | **BTL** |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | |
| **CO1** | Use basic data structures such as arrays and linked list. | K3 |
| **CO2** | Programs to demonstrate fundamental algorithmic problems including Tree Traversals, Graph traversals, and shortest paths. | K2 |
| **CO3** | Use various searching and sorting algorithms. | K3 |

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

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

**Note:** K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

| COURSE CONTENT | |
|---|---|
| **Exercise -1 (Searching)** | a) Write C program that use both recursive and non recursive functions to perform Linear search for a Key value in a given list.<br>b) Write C program that use both recursive and non recursive functions to perform Binary search for a Key value in a given list. |
| **Exercise -2 (Sorting-I)** | a) Write C program that implement Bubble sort, to sort a given list of integers in ascending order<br>b) Write C program that implement Quick sort, to sort a given list of integers in ascending order<br>c) Write C program that implement Insertion sort, to sort a given list of integers in ascending order |
| **Exercise -3 (Sorting-II)** | a) Write C program that implement radix sort, to sort a given list of integers in ascending order<br>b) Write C program that implement merge sort, to sort a given list of integers in ascending order |
| **Exercise -4 (Singly Linked List)** | a) Write a C program that uses functions to create a singly linked list<br>b) Write a C program that uses functions to perform insertion operation on a singly linked list<br>c) Write a C program that uses functions to perform deletion operation on a singly linked list<br>d) Write a C program to reverse elements of a single linked list. |
| **Exercise -5 (Queue)** | a) Write C program that implement Queue (its operations) using arrays.<br>b) Write C program that implement Queue (its operations) using linked lists |
| **Exercise -6 (Stack)** | a) Write C program that implement stack (its operations) using arrays<br>b) Write C program that implement stack (its operations) using Linked list<br>c) Write a C program that uses Stack operations to evaluate postfix expression |
| **Exercise -7 (Binary Tree)** | Write a recursive C program for traversing a binary tree in preorder, inorder and postorder. |
| **Exercise -8 (Binary Search Tree)** | a) Write a C program to Create a BST<br>b) Write a C program to insert a node into a BST.<br>c) Write a C program to delete a node from a BST. |

# Constitution of India

**Common to CE, EEE, MECH, ECE, CSE, CSE (DS), CSE (AI&ML), CSE(AI), IT**

| | | | |
|---|---|---|---|
| **Course Category** | Mandatory Course | **Course Code** | 20HM2T05 |
| **Course Type** | Theory | **L-T-P-C** | 2-0-0-0 |
| **Prerequisites** | | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 0<br>0<br>0 |

| **COURSE OUTCOMES** | | **BTL** |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | |
| **CO1** | Understand the evolution of Constitution of India | K2 |
| **CO2** | Make use of one's Fundamental rights. | K3 |
| **CO3** | Understand the functioning of the Union Government | K2 |
| **CO4** | Understand the functioning of the State and local self Government. | K2 |
| **CO5** | Understand the value of Indian Constitution in functioning of the country. | K2 |

**Note:** K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

| | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PS O1** | **PS O2** | **PS O3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | - | - | - | - | - | 3 | - | 3 | - | 1 | - | 2 | - | - | - |
| **CO 2** | - | - | - | - | - | 1 | - | 2 | 1 | 1 | - | 1 | - | - | - |
| **CO 3** | - | - | - | - | - | 1 | - | 1 | 1 | 1 | - | - | - | - | - |
| **CO 4** | - | - | - | - | - | 1 | - | 1 | 1 | 1 | - | - | - | - | - |
| **CO 5** | - | - | - | - | - | 1 | 1 | 1 | 1 | 1 | - | 2 | - | - | - |

| COURSE CONTENT | |
|---|---|
| **UNIT I** | **Introduction to Indian constitution:** Meaning of the term constitution - History and development – Preamble of the Constitution – Constituent Assembly – The salient features of Indian Constitution. |
| **UNIT II** | **Fundamental Rights:** Individual and Collective Rights – Limitations of the fundamental Rights – Fundamental Rights Vs Duties |
| **UNIT III** | **Union Government:** Union Legislature – Lok Sabha and Rajya Sabha (powers and functions) – President of India (powers and functions) – Prime minister of India (powers and functions) – Union Judiciary (supreme court powers and functions). |
| **UNIT IV** | **State Government:**State Legislature (Legislative Assembly / Vidhan Sabha, Legislative Council / Vidhan Parishad) – Powers and functions of state legislature – The Chief Minister of the state (powers and functions)<br>**Local Self Government:** Election commission of India (Powers and Functions)- The Union Public Service Commission (Powers and Functions) |
| **UNIT V** | The values of the Indian Constitution and Ushering of Social Revolution in India – Nature and Role of Higher Judiciary in India – Amendments (Recent) |

| REFERENCE BOOKS | |
|---|---|
| **1.** | Indian Polity‘ by Laxmikanth |
| **2.** | Indian Administration‘ by Subhash Kashyap |
| **3.** | Indian Constitution‘ by D.D. Basu |
| **4.** | Indian Administration‘ by Avasti and Avasti |
| **WEB RESOURCES** | |
| **1.** | https://www.clearias.com/historical-background-of-indian-constitution/ |
| **2.** | https://www.civilserviceindia.com/subject/General-Studies/notes/functions-and-responsibilities-of-the-union-and-the-states.html |
| **3.** | https://www.tutorialspoint.com/indian_polity/indian_polity_how_constitution_works |

# Transforms and Vector Calculus

**Common to CE, ME, ECE, CSE, CSE(AI&ML), CSE(AI), CSE(DS), IT**

| | | | |
|---|---|---|---|
| **Course Category** | Basic Sciences | **Course Code** | 20BM3T03 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | NIL | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | The course is designed to equip the students with the necessary mathematical skills and techniques that are essential for an engineering course. |
| **2** | The skills derived from the course will help the student form a necessary base to develop analytic and design concepts. |

| **COURSE OUTCOMES** | | **BTL** |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | |
| **CO1** | Examine the properties of Laplace transformation | K3 |
| **CO2** | Solve ordinary differential equations by using Laplace transformation technique | K2 |
| **CO3** | Expand a periodic function as a Fourier series and find Fourier transform of a given function. | K3 |
| **CO4** | Understand vector differential properties of scalar and vector point functions and their applications | K2 |
| **CO5** | Apply Green's, Stokes and Divergence theorem to evaluate line, surface and volume integrals. | K3 |

**Note:** K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

| Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
| CO1 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO3 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO4 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | - |
| CO5 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | - |

| COURSE CONTENT | |
|---|---|
| UNIT I | **Laplace transforms:** Laplace transforms of standard functions – Properties - Periodic functions - Unit step function – Dirac's delta function. |
| UNIT II | **Inverse Laplace transforms:** Inverse Laplace transforms – Properties – Convolution theorem (without proof). **Applications:** Solving ordinary differential equations (initial value problems) using Laplace transforms. |
| UNIT III | **Fourier Analysis:** Introduction- Periodic functions – Dirichlet's conditions - Fourier series of a function, even and odd functions –Change of interval – Half-range sine and cosine series. Fourier integral theorem (without proof) – Fourier sine and cosine integrals – sine and cosine transforms – Inverse transforms. |
| UNIT IV | **Vector Differentiation:** Gradient - Directional derivative - Divergence – Curl – Laplacian and second order operators – Vector identities. |
| UNIT V | **Vector Integration:** Line integral – Work done – Potential function – Area, Surface and volume integrals - Vector integral theorems: Greens, Stokes and Gauss Divergence theorems (without proof) and related problems. |


| TEXT BOOKS | |
|---|---|
| 1. | **B.S.Grewal**, Higher Engineering Mathematics, 43rd Edition, Khanna Publishers. |
| 2. | **Erwin Kreyszig**, Advanced Engineering Mathematics, 10th Edition, Wiley-India |
| REFERENCE BOOKS | |
| 1. | **Micheael Greenberg**, Advanced Engineering Mathematics, 9th edition, Pearson edn |

| | |
|---|---|
| **2.** | **Dean G. Duffy**, Advanced engineering mathematics with MATLAB, CRC Press |
| **3.** | **Peter O'neil**, Advanced Engineering Mathematics, Cengage Learning. |
| **4.** | **Srimanta Pal, Subodh C.Bhunia**, Engineering Mathematics, Oxford University Press. |
| **5.** | **T.K.V. Iyengar et. al.,** Engineering Mathematics Volume I & III S Chand Publications. |
| **6.** | **Murray R Speigel,** Schaum's Outline of Vector Analysis, Schaum's Outline. |
| **7.** | **Shanti Narayan**, Integral Calculus – Vol. 1 & II |


**WEB RESOURCES**

| | |
|---|---|
| **1.** | **UNIT I: Laplace transforms**<br>https://en.wikipedia.org/wiki/Laplace_transform<br>https://web.stanford.edu/~boyd/ee102/laplace.pdf |
| **2.** | **UNIT II: Inverse Laplace transforms**<br>https://www.intmath.com/laplace-transformation/7-inverse-laplace-transform.php |
| **3.** | **Unit – III: Fourier Analysis**<br>https://www.mathsisfun.com/calculus/fourier-series.html<br>https://lpsa.swarthmore.edu/Fourier/Xforms/FXformIntro.html |
| **4.** | **UNIT IV: Vector Differentiation**<br>https://en.wikipedia.org/wiki/Vector_calculus |
| **5.** | **UNIT V: Vector Integration**<br>https://en.wikipedia.org/wiki/Divergence_theorem<br>http://tutorial.math.lamar.edu/Classes/CalcIII/StokesTheorem.aspx |

# Advanced Data Structures through C

**Common to CSE, CSE (AI&ML), CSE(AI), CSE (DS), IT**

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 20CS3T04 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | Data Structures | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | Comprehensive understanding of dictionaries, hashing mechanism which supports faster data retrieval and skip lists |
| **2** | Illustration of Balanced trees and their operations. |
| **3** | Comprehension of heaps, queues and their operations Priority Queues. |

| **COURSE OUTCOMES** | | **BTL** |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | |
| **CO1** | Develop symbol table using hashing techniques | K3 |
| **CO2** | Implement priority queues using Binary heap and Binomial Queue and their applications | K3 |
| **CO3** | Analyze algorithms for Height balanced trees such as AVL trees, red-black trees. | K3 |
| **CO4** | Analyze algorithms for Height balanced trees B-trees and B+ trees | K3 |
| **CO5** | Develop algorithms for digital search trees, binary tries and patricia | K3 |

**Note:** K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

| Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
| **CO1** | 3 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | 2 | 2 |
| **CO2** | 3 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | 2 | 2 |
| **CO3** | 3 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | 2 | 2 |
| **CO4** | 3 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | 2 | 2 |
| **CO5** | 3 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | 2 | 2 |

| **COURSE CONTENT** | |
|---|---|
| **UNIT I** | **HASHING:**<br>Introduction-Static Hashing- Hash Table- Hash Functions- Secure Hash Function- Overflow Handling- Theoretical Evaluation of Overflow Techniques, Dynamic Hashing- Motivation for Dynamic Hashing -Dynamic Hashing Using Directories- Directory less Dynamic, Hashing. |
| **UNIT II** | **PRIORITY QUEUES (HEAPS):**<br>Model, Simple Implementation, Binary Heap-Structure Property-Heap-Order Property-Basic Heap Operations- Other Heap Operation, Applications of Priority Queues- The Selection Problem Event Simulation Problem, Binomial Queues- Binomial Queue Structure – Binomial Queue Operation Implementation of Binomial Queues |
| **UNIT III** | **EFFICIENT BINARY SEARCH TREES:**<br>Optimal Binary Search Trees, AVL Trees, Red-Black Trees, Definition- Representation of a RedBlack Tree- Searching a Red-Black Tree- Inserting into a Red Black Tree- Deletion from a RedBlack Tree- Joining Red-Black Trees, Splitting a Red-Black tree |
| **UNIT IV** | **MULTIWAY SEARCH TREES:**<br>M-Way Search Trees, Definition and Properties- Searching an M-Way Search Tree, B-Trees, Definition and Properties- Number of Elements in a B-tree- Insertion into B-Tree- Deletion from a B-Tree- B+-Tree Definition- Searching a B+-Tree- Insertion into B+-tree- Deletion from a B+-Tree. |
| **UNIT V** | **DIGITAL SEARCH STRUCTURES:**<br>Digital Search Trees, Definition- Search, Insert and Delete- Binary tries and Patricia, Binary Tries, Compressed Binary Tries- Patricia, Multiway Tries- Definitions- Searching a Trie- Sampling Strategies- Insertion into a Trie- Deletion from a Trie- Keys with Different Length- Height of a TrieSpace Required. |

| **TEXT BOOKS** | |
|---|---|
| **1.** | Fundamentals of DATA STRUCTURES in C: 2nd ed. Horowitz , Sahani, Anderson-freed, |

| | |
|---|---|
| | Universities Press |
| **2.** | Data structures and Algorithm Analysis in C, 2nd ed. Mark Allen Weiss, Pearson |
| **REFERENCE BOOKS** | |
| **1.** | Data Structures, a Pseudocode Approach, Richard F Gilberg, Behrouz A Forouzan, Cengage. |
| **2.** | File Structures :An Object oriented approach with C++, 3rd ed, Michel J Folk, Greg Riccardi, Bill Zoellick |
| **3.** | Data Structures and Algorithms : Concepts, Techniques and Applications, GAV Pai, Tata McGraw Hill Corporation, ISBN: 9780070667266, 9780070667266, 2008 |
| **WEB RESOURCES** | |
| **1.** | http://lcm.csa.iisc.ernet.in/dsa/dsa.html |
| **2.** | http://utubersity.com/?page_id=878 |
| **3.** | http://freevideolectures.com/Course/2519/C-Programming-and-Data-Structures |
| **4.** | http://freevideolectures.com/Course/2279/Data-Structures-And-Algorithms |
| **5.** | http://lcm.csa.iisc.ernet.in/dsa/dsa.html |
| **6.** | http://utubersity.com/?page_id=878 |
| **7.** | http://freevideolectures.com/Course/2519/C-Programming-and-Data-Structures |
| **8.** | http://freevideolectures.com/Course/2279/Data-Structures-And-Algorithms |

# Introduction to Artificial Intelligence

**Common to CSE(AI&ML) and CSE(AI)**

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 20CS3T05 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | Data Structures | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To provide a strong foundation of fundamental concepts in Artificial Intelligence. |
| **2** | To provide a basic exposition to the goals and methods of Artificial Intelligence. |
| **3** | To apply the techniques in applications which involve perception, reasoning and learning. |

| **COURSE OUTCOMES** | | **BTL** |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | |
| **CO1** | Enumerate the history and foundations of Artificial Intelligence | K1 |
| **CO2** | Apply the basic principles of AI in problem solving | K3 |
| **CO3** | Choose the appropriate representation of Knowledge | K4 |
| **CO4** | Solve the problems with uncertainty using probability | K4 |
| **CO5** | Examine the Scope of AI and its societal implications | K5 |

**Note:** K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

| Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PS O1** | **PS O2** | **PS O3** |
| **CO1** | 2 | 2 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | 2 | 2 |
| **CO2** | 1 | 2 | 3 | 3 | 3 | - | - | - | - | - | - | - | 1 | 2 | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 |
| **CO4** | 1 | 2 | 3 | 3 | 3 | - | - | - | - | - | - | - | 2 | 3 | - |
| **CO5** | 1 | 2 | 3 | 3 | 3 | - | - | - | - | - | - | - | 2 | 2 | 3 |

| **COURSE CONTENT** | |
|---|---|
| **UNIT I** | **Introduction:** What Is AI?, The Foundations of Artificial Intelligence, The History of Artificial Intelligence, The State of the Art, Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents. |
| **UNIT II** | **Problem Solving:** Problem-Solving Agents, Example Problems, Searching for Solutions, Uninformed Search Strategies, Informed (Heuristic) Search Strategies, Local Search Algorithms and Optimization Problems, Searching with Nondeterministic Actions. |
| **UNIT III** | **Knowledge Representation:** Knowledge-Based Agents, Logic, Propositional Logic: A Very Simple Logic, Ontological Engineering, Categories and Objects, Events, Mental Events and Mental Objects, Reasoning Systems for Categories, The Internet Shopping World. |
| **UNIT IV** | **Uncertain Knowledge and Reasoning:** Acting under Uncertainty**,** Basic Probability Notation, Inference Using Full Joint Distributions, Independence, Bayes‘ Rule and Its Use, Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks. |
| **UNIT V** | **AI present and Future:** Weak AI: Can Machines Act Intelligently?, Strong AI: Can Machines Really Think?, The Ethics and Risks of Developing Artificial Intelligence, Agent Components, Agent Architectures, Are We Going in the Right Direction?, What If AI Does Succeed?. |

| | |
|---|---|
| **TEXT BOOKS** | |
| **1.** | Stuart Russell and Peter Norvig, –Artificial Intelligence: A Modern Approach , 3rd Edition, Pearson, 2010 |
| **2.** | Elaine Rich and Kevin Knight, —Artificial Intelligence, Tata McGraw Hill, 2010 |
| **REFERENCE BOOKS** | |
| **1.** | SarojKaushik, –Artificial Intelligence, Cengage Learning India, 2011 |
| **2.** | David Poole and Alan Mackworth, –Artificial Intelligence: Foundations for Computational Agents, Cambridge University Press 2010. |
| **3.** | Trivedi, M.C., –A Classical Approach to Artifical Intelligence, Khanna Publishing House, Delhi. |
| **WEB RESOURCES** | |
| **1.** | https://nptel.ac.in/courses/106105077 |
| **2.** | https://nptel.ac.in/courses/106106126 |
| **3.** | https://aima.cs.berkeley.edu |
| **4.** | https://ai.berkeley,edu/project_overview.html |

# Database Management Systems

## Common to CSE, CSE(AI&ML), CSE(AI), CSE(DS), IT

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 20IT3T02 |
| **Course Type** | Theory | **L-T-P-C** | 3 – 0 – 0 – 3 |
| **Prerequisites** | | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To introduce about database management systems. |
| **2** | To give a good formal foundation on the relational model of data and usage of Relational Algebra. |
| **3** | To introduce the concepts of basic SQL as a universal Database language. |
| **4** | To demonstrate the principles behind systematic database design approaches by covering conceptual design, logical design through normalization. |
| **5** | To provide an overview of physical design of a database system, by discussing Database indexing techniques and storage techniques. |

| **COURSE OUTCOMES** | | |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | **Cognitive Level** |
| **CO1** | Describe a relational database and object-oriented database. | K2 |
| **CO2** | Create, maintain, and manipulate a relational database using SQL. | K3 |
| **CO3** | Describe ER model for database design. | K1 |
| **CO4** | Design a database with understanding on Normalization. | K2 |
| **CO5** | Understand the storage, recovery and accessing mechanisms. | K2 |

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

| Contribution of Course Outcomes towards achievement of Program : Outcomes (1 – Low, 2 - Medium, 3 – High) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
| **CO1** | 3 | 1 | 3 | - | - | - | - | - | - | - | - | - | 1 | 3 | - |
| **CO2** | 3 | 3 | 3 | - | - | - | - | - | 1 | - | - | 1 | 1 | 1 | 2 |
| **CO3** | 3 | 3 | 3 | 2 | - | - | - | - | 1 | - | 2 | 1 | 1 | 1 | 1 |
| **CO4** | 3 | 3 | 3 | - | - | - | - | - | 1 | - | 3 | 1 | 1 | 1 | 2 |
| **CO5** | 3 | 2 | 1 | - | - | - | - | - | 1 | - | - | 1 | 1 | 1 | 2 |

| **COURSE CONTENT** | |
|---|---|
| **UNIT I** | Introduction: Database system, Characteristics (Database Vs File System), Database Users (Actors on Scene, Workers behind the scene), Advantages of Database systems, Database applications. Brief introduction of different Data Models; Concepts of Schema, Instance and data independence; Three tier schema architecture for data independence; Database system structure, environment.<br>Entity Relationship Model: Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, sub classes, super class, inheritance, specialization, generalization using ER Diagrams. |
| **UNIT II** | Relational Model: Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, constraints (Domain, Key constraints, integrity constraints) and their importance BASIC SQL: Simple Database schema, data types, table definitions (create, alter), different DML operations (insert, delete, update), basic SQL querying (select and project) using where clause, arithmetic & logical operations, SQL functions(Date and Time, Numeric, String conversion). |
| **UNIT III** | SQL: Creating tables with relationship, implementation of key and integrity constraints, nested queries, sub queries, grouping, aggregation, ordering, implementation of different types of joins, view(updatable and non-updatable), relational setoperations.<br>Indexing Techniques: B+ Trees: Search, Insert, Delete algorithms, File Organization and Indexing, Cluster Indexes, Primary and Secondary Indexes, Index data Structures, Hash Based Indexing: Tree base Indexing, Comparison of File Organizations, Indexes and Performance Tuning |
| **UNIT IV** | Schema Refinement (Normalization): Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency(1NF, 2NF and 3 NF), concept of surrogate key, Boyce-codd normal form(BCNF), Lossless join and dependency preserving decomposition, Fourth normal form(4NF), Fifth Normal Form (5NF). |

| | |
|---|---|
| **UNIT V** | Transaction Concept: Transaction State, Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for Serializability, Failure Classification, Storage, Recovery and Atomicity, Recovery algorithm. |
| **TEXTBOOKS** | |
| **1.** | Database Management Systems, 3/e, Raghurama Krishnan, Johannes Gehrke, TMH |
| **2.** | Database System Concepts,5/e, Silberschatz, Korth, TMH |
| **REFERENCE BOOKS** | |
| **1.** | Introduction to Database Systems, 8/e C J Date, PEA. |
| **2.** | Database Management System, 6/e Ramez Elmasri, Shamkant B. Navathe, PEA |
| **3.** | Database Principles Fundamentals of Design Implementation and Management, Corlos Coronel,Steven Morris, Peter Robb, Cengage Learning. |
| **WEB RESOURCES** | |
| **1.** | https://nptel.ac.in/courses/106/105/106105175/ |
| **2.** | https://www.geeksforgeeks.org/introduction-to-nosql/ |

# Mathematical Foundations For Computer Science

**Common to CSE, CSE(AI&ML), CSE(AI), CSE(DS), IT**

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 20IT3T03 |
| **Course Type** | Theory | **L-T-P-C** | 3 – 0 – 0 – 3 |
| **Prerequisites** | | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

**COURSE OBJECTIVES**

| | |
|---|---|
| **1** | To introduce the students to the topics and techniques of discrete methods and combinatorial reasoning. |
| **2** | To introduce a wide variety of applications. The algorithmic approach to the solution of problems is fundamental in discrete mathematics, and this approach reinforces the close ties between this discipline and the area of computer science. |

**COURSE OUTCOMES**

| **Upon successful completion of the course, the student will be able to:** | | **Cognitive Level** |
|---|---|---|
| **CO1** | Demonstrate skills in solving mathematical problems | K2 |
| **CO2** | Comprehend mathematical principles and logic | K2 |
| **CO3** | Practice problems related to fundamental theorems | K2 |
| **CO4** | Solve recurrence relations of various types | K2 |
| **CO5** | Represent graphs as mathematical structure and apply graph theory in solving computer science problems. | K3 |

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

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

| COURSE CONTENT | |
|---|---|
| **UNIT I** | Mathematical Logic: Propositional Calculus: Statements and Notations, Connectives, Well Formed Formulas, Truth Tables, Tautologies, Equivalence of Formulas, Duality Law, Tautological Implications, Normal Forms, Theory of Inference for Statement Calculus, Consistency of Premises, Indirect Method of Proof<br>Predicate Calculus: Predicates, Predicative Logic, Statement Functions, Variables and Quantifiers, Free and Bound Variables, Inference Theory for Predicate Calculus. |
| **UNIT II** | Set Theory: Sets: Operations on Sets, Principle of Inclusion-Exclusion, Relations: Properties, Operations, Partition and Covering, Transitive Closure, Equivalence, Compatibility and Partial Ordering, Hasse Diagrams, Functions: Bijective, Composition, Inverse, Permutation, and Recursive Functions, Lattice and its Properties, Algebraic Structures: Algebraic Systems, Properties, Semi Groups and Monoids, Group, Subgroup and Abelian Group, Homomorphism, Isomorphism. |
| **UNIT III** | Combinatorics: Basis of Counting, Permutations, Permutations with Repetitions, Circular and Restricted Permutations, Combinations, Restricted Combinations, Binomial and Multinomial Coefficients and Theorems, Number Theory: Properties of Integers, Division Theorem, Greatest Common Divisor, Euclidean Algorithm, Least Common Multiple, Testing for Prime Numbers, The Fundamental Theorem of Arithmetic, Modular Arithmetic, Fermat‘s and Euler‘s Theorems |
| **UNIT IV** | Recurrence Relations: Generating Functions, Function of Sequences, Partial Fractions, Calculating Coefficient of Generating Functions, Recurrence Relations, Formulation as Recurrence Relations, Solving Recurrence Relations by Substitution and Generating Functions, Method of Characteristic Roots, Solving Inhomogeneous Recurrence Relations |
| **UNIT V** | Graph Theory: Basic Concepts, Graph Theory and its Applications, Sub graphs, Graph Representations: Adjacency and Incidence Matrices, Isomorphic Graphs, Paths and Circuits, Eulerian and Hamiltonian Graphs, Multigraphs, Bipartite and Planar Graphs, Euler‘s Theorem, Graph Colouring and Covering, Chromatic Number, Spanning Trees, Prim‘s and Kruskal‘s Algorithms, BFS and DFS Spanning Trees |

**TEXTBOOKS**


| | |
|---|---|
| **1.** | Discrete Mathematical Structures with Applications to Computer Science, J. P. Tremblay and P.Manohar, Tata McGraw Hill. |
| **2.** | Elements of Discrete Mathematics-A Computer Oriented Approach, C. L. Liu and D. P. Mohapatra, 3rd Edition, Tata McGraw Hill. |

| | |
|---|---|
| **3.** | Theory and Problems of Discrete Mathematics, Schaum's Outline Series, Seymour Lipschutz and Marc Lars Lipson, 3rd Edition, McGraw Hill. |
| **REFERENCE BOOKS** | |
| **1.** | Discrete Mathematics for Computer Scientists and Mathematicians, J. L. Mott, A. Kandel and T. P. Baker, 2nd Edition, Prentice Hall of India. |
| **2.** | Discrete Mathematical Structures, Bernand Kolman, Robert C. Busby and Sharon Cutler Ross, PHI. |
| **3.** | Discrete Mathematics, S. K. Chakraborthy and B.K. Sarkar, Oxford, 2011. |
| **4.** | Discrete Mathematics and its Applications with Combinatorics and Graph Theory, K. H. Rosen, 7th Edition, Tata McGraw Hill. |
| **WEB RESOURCES** | |
| **1.** | https://nptel.ac.in/courses/106/106/106106094/ |

# Advanced Data Structures through C Laboratory

**Common to CSE, CSE(AI&ML), CSE(AI), CSE(DS), IT**

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 20CS3L04 |
| **Course Type** | Laboratory | **L-T-P-C** | 0-0-3-1.5 |
| **Prerequisites** | Data Structures Laboratory | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 15<br>35<br>50 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To make the student implement efficient data structures for maintenance of data |
| **2** | To make the student implement rigid data structures for faster lookup |
| **3** | To make the student develop balanced trees and their various operations. |

| **COURSE OUTCOMES** | | **BTL** |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | |
| **CO1** | Implement programs for efficiently retrieving records with Hash tables and Heaps. | K3 |
| **CO2** | Develop programs for, efficient data storage and text processing applications. | K3 |
| **CO3** | Develop programs for implementing balanced trees and their Operations. | K3 |

**Note:** K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

| **Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)** | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** | **PSO 3** |
| **CO1** | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | 3 | 2 | - |
| **CO2** | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | 3 | 2 | - |
| **CO3** | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | 3 | 2 | - |

| COURSE CONTENT | |
|---|---|
| 1 | Implement functions of Dictionary usingHashing (division method, Multiplication method, Universal hashing) |
| 2 | Consider telephone book database of N clients. Make use of a hash table implementation to quickly look up client_s telephone number |
| 3 | Implement various operations on Priority Queue |
| 4 | Read the marks obtained by students of second year in an online examination of particular subject. Find out maximum and minimum marks obtained in that subject. Use heap data structure. |
| 5 | Implement insertion operation on AVL trees. |
| 6 | Implement deletion operation on AVL trees. |
| 7 | Implement insertion operation on Red Black trees. |
| 8 | Implement deletion operation on Red Black trees. |
| 9 | Implement various operations on M-way search tree. |
| 10 | Implement various operations on B Trees |
| 11 | Implement various operations on B+ Trees |
| 12 | Implement Search Operation with Trie |
| 13 | Given an array of integers, with Trie structure find out two elements whose XOR is maximum. |

| TEXT BOOKS | |
|---|---|
| 1. | Introduction to Algorithms," T.H. Cormen, C.E. Leiserson ,R.L. Rivest, and C. Stein, Third Edition. |
| 2. | Data Structures with C (Schaum's Outline Series) by Seymour Lipschutz, July 2017. |
| **REFERENCE BOOKS** | |
| 1. | Data Structures & Algorithm Analysis in C,SecondEdition,Mark Allen Weiss,PearsonEducation,India,January 2002 Edition. |
| 2. | Algorithm Design and Applications, Michael T Goodrich, Roberto Tamassia, John Wiley,2002. |
| 3. | Data Structures and Algorithms in C,Adam Drozdek,2004 Edition. |
| **WEB RESOURCES** | |

| | |
|---|---|
| **1.** | https://nptel.ac.in/courses/106/102/106102064/ |
| **2.** | https://www.tutorialspoint.com/advanced_data_structures/index.asp |
| **3.** | https://www.geeksforgeeks.org/advanced-data-structures/#SelfbalancingBSTs |
| **4.** | https://www.geeksforgeeks.org/trie-insert-and-search/ |
| 5. | https://www.cs.yale.edu/homes/aspnes/pinewiki/C(2f)HashTables.html?highlight=%28CategoryAlgorithmNotes%29 |

# Introduction to Artificial Intelligence through LISP/PROLOG Laboratory

**Common to CSE(AI&ML) and CSE(AI)**

| | | | |
|---|---|---|---|
| **Course Category** | | **Course Code** | 20CS3L05 |
| **Course Type** | Laboratory | **L-T-P-C** | 0-0-3-1.5 |
| **Prerequisites** | | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 15<br>35<br>50 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To provide a strong foundation of fundamental concepts in Artificial Intelligence. |
| **2** | To provide a basic exposition to the goals and methods of Artificial Intelligence. |
| **3** | To apply the techniques in applications which involve perception, reasoning and learning. |

| **COURSE OUTCOMES** | | **BTL** |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | |
| **CO1** | Apply the basic principles of AI in problem solving using LISP/PROLOG | K3 |
| **CO2** | Implement different algorithms using LISP/PROLOG | K3 |
| **CO3** | Develop an Expert System using JESS/PROLOG | K3 |

**Note:** K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

| | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PS O1** | **PS O2** | **PS O3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 3 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 |
| **CO2** | 3 | 3 | 3 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 |
| **CO3** | 3 | 3 | 3 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 |

| COURSE CONTENT | |
|---|---|
| **1** | Implementation of DFS for water jug problem using LISP/PROLOG |
| **2** | Implementation of BFS for tic-tac-toe problem using LISP/PROLOG/Java |
| **3** | Implementation of TSP using heuristic approach using Java/LISP/ PROLOG |
| **4** | Implementation of Simulated Annealing Algorithm using LISP/PROLOG |
| **5** | Implementation of Hill-climbing to solve 8- Puzzle Problem |
| **6** | Implementation of Monkey Banana Problem using LISP/PROLOG |
| **7** | Implementation of A* Algorithm using LISP/PROLOG |
| **8** | Implementation of Hill Climbing Algorithm using LISP/PROLOG |
| **9** | Implementation Expert System with forward chaining using JESS/CLIPS |
| **10** | Implementation Expert System with backward chaining using RVD/PROLOG |

| TEXT BOOKS | |
|---|---|
| **1.** | Stuart Russell and Peter Norvig, –Artificial Intelligence: A Modern Approach , 3rd Edition, Pearson. |
| **2.** | Elaine Rich and Kevin Knight, —Artificial Intelligence, Tata McGraw Hill |
| **REFERENCE BOOKS** | |
| **1.** | SarojKaushik, –Artificial Intelligence, Cengage Learning India, 2011 |
| **2.** | David Poole and Alan Mackworth, –Artificial Intelligence: Foundations for Computational Agents, Cambridge University Press 2010. |
| **3.** | Trivedi, M.C., –A Classical Approach to Artifical Intelligence, Khanna Publishing House, Delhi. |
| **WEB RESOURCES** | |
| **1.** | Prolog program of water jug problem - Prolog Tutorial \| Codepoc.io |
| **2.** | Implementation of BFS for tic-tac-toe problem using LISP /PROLOG/Java (Python) - Goeduhub Technologies |
| **3.** | Implementation of Monkey Banana Problem using LISP/PROLOG Implementation of A* |

| | |
|---|---|
| | Algorithm using LISP/PROLOG - Google Search |
| **4.** | Hill Climbing Algorithm \| Hill Climbing in Artificial Intelligence \| Data Science Tutorial \| Edureka - YouTube |
| **5.** | Forward and Backward Chaining in Artificial Intelligence \| Engineering Education (EngEd) Program \| Section |

# Database Management Systems Laboratory

**Common to CSE, CSE(AI&ML), CSE(AI), CSE(DS), IT**

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 20IT3L04 |
| **Course Type** | Laboratory | **L-T-P-C** | 0 – 0 – 3 – 1.5 |
| **Prerequisites** | | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 15<br>35<br>50 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | Populate and query a database using SQL DDL/DML Commands |
| **2** | Declare and enforce integrity constraints on a database |
| **3** | Writing Queries using advanced concepts of SQL |
| **4** | Programming PL/SQL including procedures, functions, cursors, and triggers |

| **COURSE OUTCOMES** | | |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | **Cognitive Level** |
| **CO1** | Create database tables and perform various operations | K3 |
| **CO2** | Implement PL/SQL programs | K3 |
| **CO3** | Create stored packages for variables and cursors | K3 |

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

**Contribution of Course Outcomes towards achievement of Program : Outcomes (1 – Low, 2 - Medium, 3 – High)**

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

| **LIST OF EXPERIMENTS**<br>**Note:** For performing the experiments consider any case study (ATM/ Banking/ Library/Hospitalmanagement systems) | |
|---|---|
| **1** | Creation, altering and dropping of tables and inserting rows into a table (use constraintswhile creating tables) examples using SELECT command. |
| **2** | Queries (along with sub Queries) using ANY, ALL, IN, EXISTS, NOTEXISTS, UNION, INTERSET, Constraints. Example:- Select the roll number and name |

| | |
|---|---|
| | of the student who secured fourth rank in the class. |
| **3** | Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, HAVING and Creation and dropping of Views. |
| **4** | Queries using Conversion functions (to_char, to_number and to_date), string functions (Concatenation, lpad, rpad, ltrim, rtrim, lower, upper, initcap, length, substr and instr), date functions (Sysdate, next_day, add_months, last_day, months_between, least, greatest, trunc, round, to_char, to_date) |
| **5** | i. Create a simple PL/SQL program which includes declaration section, executable section, and exception –Handling section (Ex. Student marks can be selected from the table and printed for those who secured first class and an exception can be raisedif no records were found)<br>ii. Insert data into student table and use COMMIT, ROLLBACK and SAVEPOINT in PL/SQL block. |
| **6** | Develop a program that includes the features NESTED IF, CASE and CASE expression. The program can be extended using the NULLIF and COALESCE functions. |
| **7** | Program development using WHILE LOOPS, numeric FOR LOOPS, nested loops using ERROR Handling, BUILT –IN Exceptions, USE defined Exceptions, RAISE- APPLICATION ERROR. |
| **8** | Programs development using creation of procedures, passing parameters IN and OUT of PROCEDURES. |
| **9** | Program development using creation of stored functions, invoke functions in SQL Statements and write complex functions. |
| **10** | Develop programs using features parameters in a CURSOR, FOR UPDATE CURSOR, WHERE CURRENT of clause and CURSOR variables. |
| **11** | Develop Programs using BEFORE and AFTER Triggers, Row and Statement Triggers and INSTEAD OF Triggers |
| **12** | Create a table and perform the search operation on table using indexing and non-indexingtechniques. |
| **TEXTBOOKS/SUGGESTED READING:** | |
| **1** | Oracle: The Complete Reference by Oracle Press |
| **2** | Nilesh Shah, "Database Systems Using Oracle, PHI, 2007 |
| **3** | Rick F Vander Lans, –Introduction to SQL, Fourth Edition, Pearson Education, 2007 |

# Skill Oriented Course

## Mobile App Development through Android

**Common to CSE(AI&ML), CSE(AI), CSE(DS)**

| | | | |
|---|---|---|---|
| **Course Category** | Skill Oriented Course | **Course Code** | 20CS3S03 |
| **Course Type** | Laboratory | **L-T-P-C** | 0-0-4-2 |
| **Prerequisites** | | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 15<br>35<br>50 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To understand the components and structure of mobile application development frameworks for Android and windows OS based mobiles. |
| **2** | To understand how to work with various mobile application development frameworks. |

| **COURSE OUTCOMES** | | **BTL** |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | |
| **CO1** | **Discuss** the components and different Layout for mobile application development framework for android. | K6 |
| **CO2** | **Design** Simple GUI application with the **Use** of Built in components and widgets. | K6 |
| **CO3** | **Define** a solution for complex problems | K1 |

**Note:** K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

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

| COURSE CONTENT | |
|---|---|
| **1** | Introduction to mobile technologies and devices , Android platform and applications overview |
| **2** | Setting Android development environments |
| **3** | Writing Android applications, Understanding anatomy of an Android application |
| **4** | Develop an application that uses GUI components, Font and Colours |
| **5** | Develop an application that uses Layout Managers and event listeners. |
| **6** | Write an application that draws basic graphical primitives on the screen. |
| **7** | Develop an application that makes use of databases. |
| **8** | Develop an application that makes use of Notification Manager |
| **9** | Implement an application that uses Multi-threading |
| **10** | Develop a native application that uses GPS location information |
| **11** | Implement an application that writes data to the SD card. |
| **12** | Implement an application that creates an alert upon receiving a message |
| **13** | Write a mobile application that makes use of RSS feed |
| **14** | Develop a mobile application to send an email. |
| **15** | Develop a Mobile application for simple needs (Mini Project) |


| TEXT BOOKS | |
|---|---|
| **1.** | Build Your Own Security Lab, Michael Gregg, Wiley India. |
| **REFERENCE BOOKS** | |
| **1.** | Android Programming unleashed , B.M. Harwani, Pearson, 2013. |
| **2.** | Android Programming (Big Nerd Ranch Guide), by Bill Phillips, Chris Stewart, Brian Hardy, Kristin Marsicano, Pearson, 2016 |
| **3.** | Android Programming – Pushing the limits by Hellman by Erik Hellman, WILEY, 2013 |

| WEB RESOURCES | |
|---|---|
| **1.** | The Complete Android N Developer Course –Udemy<br>https://www.udemy.com/course/complete-android-n-developer-course/?altsc=428526 |
| **2.** | Android Development Courses on Google developers training<br>https://developers.google.com/training/android/ |
| **3.** | Mobile Computing - Video course- NPTEL<br>https://nptel.ac.in/courses/106/106/106106147/# |
| **4.** | Android Tutorial – Tutorial Point https://www.tutorialspoint.com/android/index.htm |

# Essence of Indian Traditional Knowledge

**Common to CSE, CSE(AI&ML), CSE(AI), CSE(DS)**

| | | | |
|---|---|---|---|
| **Course Category** | Humanities and Social Sciences | **Course Code** | 20HM4T06 |
| **Course Type** | Mandatory | **L-T-P-C** | 2-0-0-0 |
| **Prerequisites** | | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | |

| **COURSE OUTCOMES** | | **BTL** |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | |
| **CO1** | Understand the concept of Traditional knowledge and its importance | Understanding |
| **CO2** | Know the need and importance of protecting traditional knowledge | Understanding |
| **CO3** | Know the various enactments related to the protection of traditional knowledge | Understanding |
| **CO4** | Understand the concepts of Intellectual property to protect the traditional knowledge | Understanding |
| **CO5** | Understand the importance of Traditional Knowledge in the development of different sectors | Understanding |

**Note:** K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

| | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO1 0** | **PO1 1** | **PO1 2** | **PS O1** | **PS O2** | **PS O3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 1 | 1 | 2 | - | - | 3 | - | 1 | - | 2 | - | - | - | - | - |
| **CO2** | - | - | 2 | - | - | 2 | - | 2 | 1 | - | - | 2 | - | - | - |
| **CO3** | - | - | 1 | - | - | 3 | 2 | 3 | 1 | 2 | - | 1 | - | - | - |
| **CO4** | - | - | - | - | - | 2 | 1 | 3 | 1 | 1 | - | 1 | - | - | - |
| **CO5** | 1 | - | 1 | - | - | 3 | 1 | 1 | 1 | 3 | - | 1 | - | - | - |

| COURSE CONTENT | |
|---|---|
| **UNIT I** | Introduction to traditional knowledge: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, the physical and social contexts in which traditional knowledge develop, the historical impact of social change on traditional knowledge systems. Indigenous Knowledge (IK), characteristics, traditional knowledge vis-à- vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge vis-à-vis formal knowledge |
| **UNIT II** | Protection of Traditional Knowledge: The need for protecting traditional knowledge - Significance of Traditional knowledge Protection-Role of government to harness Traditional Knowledge |
| **UNIT III** | Legal framework and TK: A: The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmers Rights Act, 2001 (PPVFR Act);<br>B: The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016.Geographical indications act 2003. |
| **UNIT IV** | Traditional knowledge and intellectual property: Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Certain non IPR mechanisms of traditional knowledge protection, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge, global legal FORA for increasing protection of Indian Traditional Knowledge. |
| **UNIT V** | Traditional knowledge in different sectors: Traditional knowledge and engineering, Traditional medicine system, TK and biotechnology, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK. |

| REFERENCE BOOKS | |
|---|---|
| **1.** | Traditional Knowledge System in India, by Amit Jha, 2009. |
| **2.** | Traditional Knowledge System and Technology in India by Basanta Kumar Mohanta and Vipin Kumar Singh, Pratibha Prakashan 2012. |
| **3.** | Sivaramakrishnan (Ed.), Cultural Heritage of India-course material, Bharatiya Vidya |
| **4.** | Swami Jitatmanand, Holistic Science and Vedant, Bharatiya Vidya Bhavan |
| **5.** | Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkata. |
| **6.** | Pramod Chandra, India Arts, Howard Univ. Press, 1983. |

| | |
|---|---|
| **7.** | Krishna Chaitanya, Arts of India, Abhinav Publications, 1987. |
| **WEB RESOURCES** | |
| **1.** | https://www.wipo.int/wipo_magazine/en/2017/01/article_0004.html |
| **2.** | http://iks.iitgn.ac.in/wp-content/uploads/2016/01/Indian-Knowledge-Systems-Kapil-Kapoor.pdf |
| **3.** | https://www.wipo.int/edocs/mdocs/tk/en/wipo_grtkf_ic_21/wipo_grtkf_ic_21_ref_facilitators_text.pdf |

# Probability & Statistics

**Common to CSE, CSE(AI&ML), CSE(AI), CSE(DS)**

| | | | |
|---|---|---|---|
| **Course Category** | Basic Sciences | **Course Code** | 20BM4T05 |
| **Course Type** | Theory | **L-T-P-C** | 3 – 0 – 0 – 3 |
| **Prerequisites** | | **Internal Assessment** | 30 |
| | | **Semester End Examination** | 70 |
| | | **Total Marks** | 100 |

**COURSE OBJECTIVES**

| | |
|---|---|
| **1** | To familiarize the students with the foundations of probability and statistical methods |
| **2** | To impart probability concepts and statistical methods in various applications |

**COURSE OUTCOMES**

| **Upon successful completion of the course, the student will be able to:** | | **Cognitive Level** |
|---|---|---|
| **CO1** | Classify the concepts of data science and its importance. | K2 |
| **CO2** | Interpret the association of characteristics and through correlation and regression tools. | K3 |
| **CO3** | Make use of the concepts of probability and their applications Apply discrete and continuous probability distributions . | K3 |
| **CO4** | Design the components of a classical hypothesis test. | K4 |
| **CO5** | Infer the statistical inferential methods based on small and large sampling tests . | K3 |

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

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

| COURSE CONTENT | |
|---|---|
| **UNIT I** | **Descriptive statistics and methods for data science**: Data science – Statistics Introduction – Population vs Sample – Collection of data – primary and secondary data – Type of variable: dependent and independent Categorical and Continuous variables – Data visualization – Measures of Central tendency – Measures of Variability (spread or variance) – Skewness Kurtosis. |
| **UNIT II** | **Correlation and Curve fitting**: Correlation – correlation coefficient – rank correlation – regression coefficients and properties – regression lines – Method of least squares – Straight line – parabola – Exponential – Power curves. |
| **UNIT III** | **Probability and Distributions**: Probability – Conditional probability and Baye's theorem – Random variables – Discrete and Continuous random variables – Distribution function – Mathematical Expectation and Variance – Binomial, Poisson, Uniform and Normal distributions. |
| **UNIT IV** | **Sampling Theory**: Introduction – Population and samples – Sampling distribution of Means and Variance (definition only) – Central limit theorem (without proof) – Introduction to t, $\chi^2$ and F-distributions – Point and Interval estimations – Maximum error of estimate |
| **UNIT V** | **Tests of Hypothesis:** Introduction – Hypothesis – Null and Alternative Hypothesis – Type I and Type II errors – Level of significance – One tail and two-tail tests – Tests concerning one mean and two means (Large and Small samples) – Tests on proportions. |

| TEXTBOOKS | |
|---|---|
| **1.** | Miller and Freund's, Probability and Statistics for Engineers,7/e, Pearson, 2008. |
| **2.** | S. C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons Publications, 2012. |

| REFERENCE BOOKS | |
|---|---|
| **1.** | Shron L. Myers, Keying Ye, Ronald E Walpole, Probability and Statistics Engineers and the Scientists,8th Edition, Pearson 2007. |
| **2.** | Jay l. Devore, Probability and Statistics for Engineering and the Sciences, 8th Edition, Cengage |
| **3.** | Sheldon M. Ross, Introduction to probability and statistics Engineers and the Scientists, 4th Edition, Academic Foundation, 2011. |
| **4.** | Johannes Ledolter and Robert V. Hogg, Applied statistics for Engineers and Physical |

| | |
|---|---|
| | Scientists, 3rd Edition, Pearson, 2010. |
| **WEB RESOURCES** | |
| **1.** | **UNIT I:** https://en.wikipedia.org/wiki/List_of_probability_distributions<br>https://en.wikipedia.org/wiki/Binomial_distribution |
| **2.** | **UNIT II:**<br>https://en.wikipedia.org/wiki/Normal_distribution |
| **3.** | **UNIT III:** https://en.wikipedia.org/wiki/Sampling_(statistics)<br>https://nptel.ac.in/courses/111104073/ |
| **4.** | **UNIT IV:** https://en.wikipedia.org/wiki/Statistical_hypothesis_testing<br>https://machinelearningmastery.com/statistical-hypothesis-tests/ |
| **5.** | **UNIT V:**<br>https://en.wikipedia.org/wiki/Regression_analysis<br>https://www.surveysystem.com/correlation.htm |

# Computer Organization

## Common to CSE, CSE(AI&ML), CSE(AI), CSE(DS)

| | | | |
|---|---|---|---|
| **Course Category** | Engineering Sciences | **Course Code** | 20EC4T12 |
| **Course Type** | Theory | **L-T-P-C** | 3 – 0 – 0 – 3 |
| **Prerequisites** | | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **The student will learn** | |
| **1** | Principles and the Implementation of Computer Arithmetic |
| **2** | Operation of CPUs including RTL, ALU, Instruction Cycle and Busses |
| **3** | Fundamentals of different Instruction Set Architectures and their relationship to the CPU Design |
| **4** | Memory System and I/O Organization |
| **5** | Principles of Operation of Multiprocessor Systems and Pipelining |

| **COURSE OUTCOMES** | | |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | **Cognitive Level** |
| **CO1** | Develop a detailed understanding of computer systems | K2 |
| **CO2** | Cite different number systems, binary addition and subtraction, standard, floating-pointand micro-operations | K2 |
| **CO3** | Develop a detailed understanding of architecture and functionality of central processing unit | K4 |
| **CO4** | Exemplify in a better way the I/O and memory organization | K3 |
| **CO5** | Illustrate concepts of parallel processing, pipelining and inter processor communication | K3 |

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

| Contribution of Course Outcomes towards achievement of ProgramOutcomes (1 – Low, 2 - Medium, 3 – High) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |
| **CO1** | 3 | 1 | 1 | | | | | | | 1 | | | | |
| **CO2** | 1 | 2 | 2 | | | | | | | 1 | | | 1 | |
| **CO3** | 2 | 1 | 2 | | | | | | | 1 | | | | 2 |
| **CO4** | 2 | 3 | 2 | | | | | | | 1 | | | 2 | |
| **CO5** | 1 | 2 | 1 | | | | | | | | | | | 1 |

| **COURSE CONTENT** | |
|---|---|
| **UNIT-I** | Basic Structure of Computers: Basic Organization of Computers, Historical Perspective, Bus Structures, Data Representation: Data types, Complements, Fixed Point Representation. Floating Point Representation. Other Binary Codes, Error Detection Codes. Computer Arithmetic: Addition and Subtraction, Multiplication Algorithms, Division Algorithms. |
| **UNIT-II** | Register Transfer Language and Micro-operations: Register Transfer language. Register Transfer Bus and Memory Transfers, Arithmetic Micro operations, Logic Micro Operations, Shift Micro Operations, Arithmetic Logic Shift Unit.<br>Basic Computer Organization and Design: Instruction Codes, Computer Register, Computer Instructions, Instruction Cycle, Memory – Reference Instructions. Input –Output and Interrupt, Complete Computer Description. |
| **UNIT-III** | Central Processing Unit: General Register Organization, STACK Organization. Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Reduced Instruction Set Computer.<br>Microprogrammed Control: Control Memory, Address Sequencing, Micro Program example, Design of Control Unit. |
| **UNIT-IV** | Memory Organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory.<br>Input-Output Organization: Peripheral Devices, Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupts, Direct Memory Access |
| **UNIT-V** | Multi Processors: Introduction, Characteristics of Multiprocessors, Interconnection Structures, Inter Processor Arbitration.<br>Pipeline: Parallel Processing, Pipelining, Instruction Pipeline, RISC Pipeline, Array Processor. |

| | |
|---|---|
| **TEXT BOOKS** | |
| **1.** | Computer System Architecture, M. Morris Mano, Third Edition, Pearson, 2008. |
| **2.** | Computer Organization, Carl Hamacher, ZvonkoVranesic, SafwatZaky, 5/e, McGrawHill, 2002. |
| **REFERENCE BOOKS** | |
| **1.** | Computer Organization and Architecture, William Stallings, 6/e, Pearson, 2006. |
| **2.** | Structured Computer Organization, Andrew S. Tanenbaum, 4/e, Pearson, 2005. |
| **3.** | Fundamentals of Computer Organization and Design, Sivarama P. Dandamudi, Springer,2006. |

# Data Mining

**Common to CSE(AI&ML), CSE(AI), CSE(DS)**

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 20 CS4T07 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | Data Structures | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To understand and implement classical models and algorithms in data ware housing and data mining. |
| **2** | To analyze the data, identify the problems, and choose the relevant models and algorithms to apply. |
| **3** | To assess the strengths and weaknesses of various methods and algorithms and to analyze their behavior. |

| **COURSE OUTCOMES** | | **BTL** |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | |
| **CO1** | Summarize the architecture of data warehouse | Understanding |
| **CO2** | Apply different preprocessing methods, Similarity, Dissimilarity measures for any given raw data. | Applying |
| **CO3** | Construct a decision tree and resolve the problem of model overfitting | Applying |
| **CO4** | Compare Apriori and FP-growth association rule mining algorithms for frequent itemset generation | Understanding |
| **CO5** | Apply suitable clustering algorithm for the given data set | Applying |

**Note:** K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

| Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
| CO1 | 3 | 2 | 2 | 1 | 2 | - | - | - | - | - | - | - | - | - | - |
| CO2 | 3 | 2 | 2 | 1 | 2 | - | - | - | - | - | - | - | - | - | - |
| CO3 | 3 | 2 | 1 | 2 | 2 | - | - | - | - | - | - | - | - | - | - |
| CO4 | 3 | 3 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | - |
| CO5 | 3 | 2 | 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | - |

| COURSE CONTENT | |
|---|---|
| UNIT I | **Data Warehouse and OLAP Technology:** An Overview: Data Warehouse, A Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, From Data Warehousing to Data Mining. (Han &Kamber) |
| UNIT II | **Data Mining:** Introduction, What is Data Mining?, Motivating challenges, The origins of Data Mining, Data Mining Tasks, Types of Data, Data Quality.<br>Data Preprocessing: Aggregation, Sampling, Dimensionality Reduction, Feature Subset Selection, Feature creation, Discretization and Binarization, Variable Transformation, Measures of Similarity and Dissimilarity. (Tan & Vipin) |
| UNIT III | **Classification:** Basic Concepts, General Approach to solving a classification problem, Decision Tree Induction: Working of Decision Tree, building a decision tree, methods for expressing an attribute test conditions, measures for selecting the best split, Algorithm for decision tree induction.<br>**Model Overfitting:** Due to presence of noise, due to lack of representation samples, evaluating the performance of classifier: holdout method, random sub sampling, cross-validation, bootstrap. Bayes Theorem, Naïve Bayes Classifier (Tan & Vipin) |
| UNIT IV | **Association Analysis:** Basic Concepts and Algorithms: Problem Definition, Frequent Item Set Generation, Apriori Principle, Apriori Algorithm, Rule Generation, Compact Representation of Frequent Itemsets, FPGrowth Algorithm. (Tan & Vipin) |
| UNIT V | **Cluster Analysis:** Basic Concepts and Algorithms: Overview, What Is Cluster Analysis? Different Types of Clustering, Different Types of Clusters; K-means: The Basic K-means |

| | |
|---|---|
| | Algorithm, K-means Additional Issues, Bisecting K-means, Strengths and Weaknesses; Agglomerative Hierarchical Clustering: Basic Agglomerative Hierarchical Clustering Algorithm DBSCAN: Traditional Density Center-Based Approach, DBSCAN Algorithm, Strengths and Weaknesses. (Tan &Vipin) |

| **TEXT BOOKS** | |
|---|---|
| **1.** | Introduction to Data Mining : Pang-Ning Tan & Michael Steinbach, Vipin Kumar, Fifth Impression, Pearson, 2015. |
| **2.** | Data Mining concepts and Techniques, 3rd Edition, Jiawei Han, Michel Kamber, Elsevier, 2011 |
| **REFERENCE BOOKS** | |
| **1.** | Data Mining Techniques and Applications: An Introduction, Hongbo Du, Cengage Learning, 2010 |
| **2.** | Data Mining : Introductory and Advanced topics : Dunham, First Edition, Pearson, 2020 |
| **3.** | Data Warehousing Data Mining & OLAP, Alex Berson, Stephen Smith, TMH, 2008 |
| **4.** | Data Mining Techniques, Arun K Pujari, Universities Press, 2013, 3rd edition, |
| **WEB RESOURCES** | |
| **1.** | NPTEL Online Course on Data Mining : https://onlinecourses.nptel.ac.in/noc18_cs14/preview |
| **2.** | https://www.javatpoint.com/data-mining |
| **3.** | https://www.tutorialspoint.com/data_mining/index.htm |

# Java Programming

**Common to CSE, CSE(AI&ML), CSE(AI), CSE(DS), IT**

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 20CS4T10 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | Data Structures | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To learn the fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries. |
| **2** | To learn how to extend Java classes with inheritance and dynamic binding and how to use exception handling in Java applications |
| **3** | To understand how to design applications with threads and JDBC connections in Java |

| **COURSE OUTCOMES** | | **BTL** |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | |
| **CO1** | Differentiate the application of decision and iteration control structures. | K2 |
| **CO2** | Implements the concepts of Java such as classes, method overloading and various keywords. | K3 |
| **CO3** | Apply the concept of inheritance and interfaces. | K3 |
| **CO4** | Able to implements the concepts of Packages and Exception handling. | K3 |
| **CO5** | Able to Analyze & Implement the concepts of Multi threading and JDBC Connections. | K4 |

**Note:** K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

| Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
| CO1 | 3 | 3 | 3 | 2 | 3 | - | - | - | - | - | - | - | 3 | 3 | 2 |
| CO2 | 3 | 3 | 3 | 2 | 3 | - | - | - | - | - | - | - | 3 | 3 | 2 |
| CO3 | 3 | 3 | 3 | 2 | 3 | - | - | - | - | - | - | - | 3 | 3 | 2 |
| CO4 | 3 | 3 | 3 | 2 | 3 | - | - | - | - | - | - | - | 3 | 3 | 2 |
| CO5 | 3 | 3 | 3 | 2 | 3 | - | - | - | - | - | - | - | 3 | 3 | 2 |

| COURSE CONTENT | |
|---|---|
| UNIT I | Program Structure in Java: Introduction, Writing Simple Java Programs, Tokens in Java Programs, Command Line Arguments, Comments.<br>Data Types, Variables, and Operators: Introduction, Data Types in Java, Static Variables and Methods, Attribute Final, Operators.<br>Control Statements: If Expression, Switch Statement, Loops. |
| UNIT II | Classes and Objects: Introduction, Class Declaration and Modifiers, Class Members, Declaration of Class Objects, Constructor Methods, Nested Classes, Final Class and Methods, Passing Arguments by Value and by Reference, Keyword this.<br>Methods: Introduction, Defining Methods, Overloaded Methods, Overloaded Constructor Methods, Recursive Methods, Nesting of Methods, Overriding Methods, Attributes Final and Static. |
| UNIT III | Arrays: Introduction, Operations on Array Elements, Sorting and Searching, Two-dimensional Arrays<br>Inheritance: Introduction, Process of Inheritance, Types of Inheritances, Application of Keyword Super, Constructor Method and Inheritance, Method Overriding, Dynamic Method Dispatch, Abstract Classes, Interfaces and Inheritance.<br>Interfaces: Introduction, Declaration of Interface, Implementation of Interface, Multiple Interfaces, Nested Interfaces |
| UNIT IV | Packages and Java Library: Introduction, Defining Package, Importing Packages and Classes into Programs, Java.lang Package and its Classes, class Math, Wrapper Classes, Java util Classes and Interfaces, Time Package, Class Instant (java.time.Instant).<br>Exception Handling: Introduction, Keywords throws and throw, try, catch, and finally Blocks, Multiple Catch Clauses, Class Throwable, Unchecked Exceptions, Checked Exceptions, try-with-resources, Catching Subclass Exception, Custom Exceptions |
| UNIT V | String Handling in Java: Introduction, Interface Char Sequence, Class String, String Methods, Data Conversion and Miscellaneous Methods, Class String Buffer, Class String Builder.<br>Introducing the AWT: Graphics,Text, Layout Managers, Menus and Images<br>Swing: Origins, Features, MVC Connection, Components and Containers<br>Multithreaded Programming: Introduction, Thread Class, Main Thread- Creation of New Threads, Thread States<br>Java Database Connectivity: Introduction, JDBC Architecture, Establishing JDBC Database Connections |

| | |
|---|---|
| **TEXT BOOKS** | |
| **1.** | Introduction to Java Programming, 7th edition by Y Daniel Liang, Pearson |
| **2.** | The complete Reference Java, 8th edition, Herbert Schildt, TMH. |
| **REFERENCE BOOKS** | |
| **1.** | JAVA one step ahead, Anitha Seth, B.L.Juneja, Oxford. |
| **2.** | Murach's Java Programming, Joel Murach |
| **WEB RESOURCES** | |
| **1.** | https://nptel.ac.in/courses/106/105/106105191/ |
| **2.** | https://www.w3schools.com/java/java_data_types.asp |
| **3.** | https://docs.oracle.com/javase/tutorial/java/index.html |

# Managerial Economics and Financial Analysis

**Common to CSE, CSE(AI&ML), CSE(AI), CSE(DS)**

| | | | |
|---|---|---|---|
| **Course Category** | Humanities and Social Sciences | **Course Code** | 20HM4T01 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OUTCOMES** | | **BTL** |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | |
| **CO1** | Make use of the concepts of managerial economics and demand in managerial decision making and predicting demand for goods and services | Applying |
| **CO2** | Assess the functional relation among production, cost of production, cost concepts and Break-Even Analysis. | Evaluating |
| **CO3** | Classify market structures for price and output decisions and Appraise the forms of business organizations and trade cycles in economic growth. | Understanding |
| **CO4** | Make use of the final accounting statements in financial decision making | Applying |
| **CO5** | Apply capital budgeting techniques in financial decision making | Applying |

**Note:** K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

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

| COURSE CONTENT | |
|---|---|
| **UNIT I** | Introduction to Managerial Economics and demand Analysis: Definition of Managerial Economics and Scope-Managerial Economics and its relation with other subjects-Basic Economic Tools used in Managerial Economics-Concepts of Demand-Types-Determinants-Law of Demand its Exceptions-Elasticity of Demand-Types and Measurement- Demand forecasting and Methods of demand forecasting (Opinion survey methods, Trend line by observation, least squares method and barometric techniques) |
| **UNIT II** | Production and Cost Analysis: Production function- Law of Variable proportions- Iso-quants and Isocosts- Laws of Returns to Scale-Cobb-Douglas Production function-Economies of Scale-Cost Concepts- Fixed vs Variable Costs-Out of Pocket Costs vs Imputed Costs-Cost Volume Profit analysis-Determination of Break-Even Point (Simple Problems). |
| **UNIT III** | Introduction to Markets, Pricing Policies and Types of Business Organizations: Market Structures: Perfect Competition, Monopoly, Monopolistic and Oligopoly – Features – Price and Output Determination. Pricing Policies: Methods of Pricing: Limit Pricing, Market Skimming Pricing, Internet Pricing: Flat Rate Pricing, Usage sensitive, Transaction based pricing, Priority Pricing.<br>Types of Business Organization and Business Cycles: Features and Evaluation of Sole Trader – Partnership – Joint Stock Company – State/Public Enterprises and their forms – Business Cycles – Meaning and Features – Phases of Business Cycles. |
| **UNIT IV** | Introduction to Accounting and Capital Budgeting: Introduction to Double Entry Systems-Journal-Ledger- Trail Balance - Preparation of Final Accounts (Simple Problems) |
| **UNIT V** | Capital Budgeting: Meaning of Capital-Capitalization-Meaning of Capital Budgeting-Need for Capital Budgeting-Techniques of Capital Budgeting-Traditional and Modern Methods(Simple Problems) |

| TEXT BOOKS | |
|---|---|
| **1.** | Dr. A. R. Aryasri – Managerial Economics and Financial Analysis – TMH- 2018 |
| **2.** | Dr. N. Appa Rao, Dr. P. Vijay Kumar - _Managerial Economics and Financial Analysis‘ - Cengage Publications – 2012 |
| **REFERENCE BOOKS** | |
| **1.** | V. Maheswari -Managerial Economics - Sultan Chand & Sons – 2014. |
| **2.** | Suma Damodaran - Managerial Economics - Oxford - 2011. |
| **3.** | Vanitha Agarwal - Managerial Economics - Pearson Publications- 2011. |
| **4.** | V.Maheswari - Financial Accounting- Vikas Publications – 2018. |

| | |
|---|---|
| **5.** | S. A. Siddiqui & A. S. Siddiqui - Managerial Economics and Financial Analysis - New Age International Publishers - 2012 |

**WEB RESOURCES**

| | |
|---|---|
| **1.** | https://economictimes.indiatimes.com/definition/law-of-supply |
| **2.** | https://sites.google.com/site/economicsbasics/managerial-theories-of-the-firm |
| **3.** | https://www.managementstudyguide.com/capitalization.htm |

# R Programming Laboratory

**Common to CSE, CSE(AI&ML), CSE(AI), CSE(DS), IT**

| | | | |
|---|---|---|---|
| **Course Category** | | **Course Code** | 20CS4L10 |
| **Course Type** | Laboratory | **L-T-P-C** | 0-0-3-1.5 |
| **Prerequisites** | | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 15<br>35<br>50 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | Student will learn about the fundamentals of R programming, standard R libraries, solid understanding of R functions,write programs using the R and gain skills in R programming Language, get acquaintances with Arrays, Files, Strings, Packages, and distributions using R. |

| **COURSE OUTCOMES** | | **BTL** |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | |
| **CO1** | Implement basic concepts of R programming, and its different module that includes conditional, looping, lists, Strings, Functions, Frames, Arrays, and File programming. | K3 |
| **CO2** | Implement the concepts of R Script to extract the data from data frames and file operations. | K4 |
| **CO3** | Implement the various statistical techniques using R. Extend the functionality of R by using add-on packages. Use R Graphics and Tables to visualize results of various statistical operations on data. | K6 |

**Note:** K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

| | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO1 0** | **PO1 1** | **PO1 2** | **PSO 1** | **PSO 2** | **PSO 3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | 3 | 3 | 3 | 3 |
| **CO2** | 2 | 2 | 3 | 3 | 3 | - | - | - | - | - | - | 3 | 3 | 3 | 3 |
| **CO3** | 2 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | 3 | 3 | 3 | 3 |

| COURSE CONTENT | |
|---|---|
| **Week 1** | Installing R and RStudio<br>Basic functionality of R, variable, data types in R |
| **Week 2** | a) Implement R script to show the usage of various operators available in R language.<br>b) Implement R script to read person_s age from keyboard and display whether he is eligiblefor voting ornot.<br>c) Implement R script to find biggest number between two numbers.<br>d) Implement R script to check the given year is leap year ornot. |
| **Week 3** | a) Implement R Script to create a list.<br>b) Implement R Script to access elements in the list.<br>c) Implement R Script to merge two or more lists. Implement R Script to perform matrix operation |
| **Week 4** | Implement R script to perform following operations:<br>a) various operations on vectors<br>b) Finding the sum and average of given numbers using arrays.<br>c) To display elements of list in reverse order.<br>d) Finding the minimum and maximum elements in the array. |
| **Week 5** | a) Implement R Script to perform various operations on matrices<br>b) Implement R Script to extract the data from dataframes.<br>c) Write R script to display file contents.<br>d) Write R script to copy file contents from one file to another |
| **Week 6** | a) Write an R script to find basic descriptive statistics using summary, str, quartile function on mtcars& cars datasets.<br>b) Write an R script to find subset of dataset by using subset (), aggregate () functions on iris dataset |
| **Week 7** | a) Reading different types of data sets (.txt, .csv) from Web or disk and writing in file in specific disk location.<br>b) Reading Excel data sheet in R.<br>c) Reading XML dataset in R |
| **Week 8** | a) Implement R Script to create a Pie chart, Bar Chart, scatter plot and Histogram (Introduction toggplot2 graphics)<br>b) Implement R Script to perform mean, median, mode, range, summary, variance, standard deviation operations. |
| **Week 9** | a) Implement R Script to perform Normal, Binomial distributions.<br>b) Implement R Script to perform correlation, Linear and multiple regression. |
| **Week 10** | Introduction to Non-Tabular Data Types: Time series, spatial data, Network data. Data Transformations: Converting Numeric Variables into Factors, Date Operations, String Parsing, Geocoding |
| **Week 11** | Introduction Dirty data problems: Missing values, data manipulation, duplicates, forms of data dates,outliers, spelling |
| **Week 12** | Data sources: SQLite examples for relational databases, Loading SPSS and SAS files, Reading from Google Spreadsheets, API and web scraping examples |

| | |
|---|---|
| **TEXT BOOKS** | |
| **1.** | The R Book, by Michael J. Crawley, 2012. Wiley, 1076 p. ISBN-13: 978-0470973929 |
| **2.** | An Introduction using R, by Michael J. Crawley, 2014. John Wiley & Sons, 360 p. ISBN-13: 978-1118941096 |
| **REFERENCE BOOKS** | |
| **1.** | R Cookbook Paperback – 2011 by Teetor Paul O Reilly Publications |
| **2.** | Beginning R: The Statistical Programming Language by Dr. Mark Gardener, Wiley Publications |
| **3.** | R Programming For Dummies by JorisMeysAndrie de Vries, Wiley Publications |
| **4.** | Hands-On Programming with R by Grolemund, O Reilly Publications |
| **5.** | Statistical Programming in R by KG Srinivas G.M. Siddesh, ChetanShetty&Sowmya B.J. - 2017 edition |
| **6.** | R Fundamentals and Programming Techniques, ThomasLumely. |
| **7.** | R for Everyone Advanced Analytics and Graphics, Jared P. Lander- Addison Wesley Series |
| **8.** | The Art of R Programming, Norman Matloff, Cengage Learning |
| **9.** | Maria Dolores Ugarte, Ana F.Militino, AlanT.Arnholt—Probability and Statistics with R, 2nd Edition, CRC Press,2016. |
| **10.** | R-programming for Data science, Roger D.Peng. |
| **11.** | An Introduction to statistical learning-with applications in R, Trevor Hastie and Rob Tibshirani. |
| **WEB RESOURCES** | |
| **1.** | URL: https://cran.r-project.org/doc/manuals/r-release/R-intro.pdf ( Online Resources) |
| **2.** | http://nptel.ac.in/courses/106104135/48 |
| **3.** | http://nptel.ac.in/courses/110106064/ |
| **SOFTWARE Requirements** | |
| **1.** | The R statistical software program. Available from: https://www.r-project.org/ |
| **2.** | RStudio an Integrated Development Environment (IDE) for R. Available from: https://www.rstudio.com/ |

# Data Mining using Python Laboratory

**Common to CSE(AI&ML), CSE(AI), CSE(DS)**

| | | | |
|---|---|---|---|
| **Course Category** | | **Course Code** | 20CS4L11 |
| **Course Type** | Laboratory | **L-T-P-C** | 0-0-3-1.5 |
| **Prerequisites** | | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 15<br>35<br>50 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | Practical exposure on implementation of well-known data mining algorithms |
| **2** | Learning performance evaluation of data mining algorithms in a supervised and an unsupervised setting. |

| **COURSE OUTCOMES** | | **BTL** |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | |
| **CO1** | Apply preprocessing techniques on real world datasets | K3 |
| **CO2** | Apply apriori algorithm to generate frequent itemsets | K3 |
| **CO3** | Apply Classification and clustering algorithms on different datasets. | K3 |

**Note:** K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

| **Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)** | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PS O1** | **PS O2** | **PS O3** |
| **CO1** | 3 | 2 | 3 | 3 | 3 | - | - | - | - | - | - | - | 3 | 2 | 3 |
| **CO2** | 3 | 2 | 3 | 3 | 3 | - | - | - | - | - | - | - | 3 | 2 | 3 |
| **CO3** | 3 | 2 | 3 | 3 | 3 | - | - | - | - | - | - | - | 3 | 2 | 3 |

| **COURSE CONTENT**<br>Use python library scikit-learn wherever necessary | |
|---|---|
| **1** | Demonstrate the following data preprocessing tasks using python libraries. |

| | |
|---|---|
| | a) Loading the dataset<br>b) Identifying the dependent and independent variables<br>c) Dealing with missing data |
| **2** | Demonstrate the following data preprocessing tasks using python libraries.<br>a) Dealing with categorical data<br>b) Scaling the features<br>c) Splitting dataset into Training and Testing Sets |
| **3** | Demonstrate the following Similarity and Dissimilarity Measures using python<br>a) Pearson's Correlation<br>b) Cosine Similarity<br>c) Jaccard Similarity<br>d) Euclidean Distance<br>e) Manhattan Distance |
| **4** | Build a model using linear regression algorithm on any dataset. |
| **5** | Build a classification model using Decision Tree algorithm on iris dataset |
| **6** | Apply Naïve Bayes Classification algorithm on any dataset |
| **7** | Generate frequent itemsets using Apriori Algorithm in python and also generate association rules for any market basket data. |
| **8** | Apply K- Means clustering algorithm on any dataset. |
| **9** | Apply Hierarchical Clustering algorithm on any dataset. |
| **10** | Apply DBSCAN clustering algorithm on any dataset. |

| | |
|---|---|
| **TEXT BOOKS** | |
| **1.** | Data Mining Concepts and Techniques Third Edition, Jiawei Han, Micheline Kamber, Jian Pei |
| **REFERENCE BOOKS** | |
| **1.** | Hands-On Machine Learning with Scikit-Learn and TensorFlow, OREILLY Concepts Tools and Techniques to build Intelligent systems |
| **2.** | Python for Everybody *By Dr Charles R. Severance* |
| **WEB RESOURCES** | |
| **1.** | https://analyticsindiamag.com/data-pre-processing-in-python/ |

| | |
|---|---|
| **2.** | https://towardsdatascience.com/decision-tree-in-python-b433ae57fb93 |
| **3.** | https://towardsdatascience.com/calculate-similarity-the-most-relevant-metrics-in-a-nutshell-9a43564f533e |
| **4.** | https://www.springboard.com/blog/data-mining-python-tutorial/ |
| **5.** | https://medium.com/analytics-vidhya/association-analysis-in-python-2b955d0180c |
| **6.** | https://www.datacamp.com/community/tutorials/naive-bayes-scikit-learn |
| **7.** | https://www.analyticsvidhya.com/blog/2019/05/beginners-guide-hierarchical-clustering/ |
| **8.** | https://towardsdatascience.com/dbscan-algorithm-complete-guide-and-application-with-python-scikit-learnd690cbae4c5d |

# Java Programming Laboratory

**Common to CSE, CSE(AI&ML), CSE(AI), CSE(DS), IT, ECE**

| | | | |
|---|---|---|---|
| **Course Category** | | **Course Code** | 20CS4L12 |
| **Course Type** | Laboratory | **L-T-P-C** | 0-0-3-1.5 |
| **Prerequisites** | | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 15<br>35<br>50 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | Practice programming in the Java |
| **2** | Gain knowledge of object-oriented paradigm in the Java programming language |
| **3** | Learn use of Java in a variety of technologies and on different platforms |

| **COURSE OUTCOMES** | | **BTL** |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | |
| **CO1** | Evaluate default value of all primitive data type, Operations, Expressions, Controlflow, Strings | K3 |
| **CO2** | Determine Class, Objects, Methods, Inheritance, Exception, Runtime Polymorphism, User defined Exception handling mechanism | K3 |
| **CO3** | Illustrating simple inheritance, multi-level inheritance, Exception handling mechanism | K3 |

**Note:** K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

| | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PS O1** | **PS O2** | **PS O3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 2 | 3 |
| **CO2** | 3 | 3 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 2 | 3 |
| **CO3** | 3 | 3 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 2 | 3 |

| COURSE CONTENT | |
|---|---|
| 1 | **Exercise - 1** (Basics)<br>a) Write a JAVA program to display default value of all primitive data type of JAVA<br>b) Write a java program that display the roots of a quadratic equation $ax^2+bx=0$. Calculate the discriminate D and basing on value of D, describe the nature ofroot.<br>c) Five Bikers Compete in a race such that they drive at a constant speed which may or may not be the same as the other. To qualify the race, the speed of a racer must be more than the average speed of all 5 racers. Take as input the speed of each racer and print back the speed of qualifying racers. |
| 2 | **Exercise - 2** (Operations, Expressions, Control-flow, Strings)<br>a) Write a JAVA program to search for an element in a given list of elements using binary search mechanism.<br>b) Write a JAVA program to sort for an element in a given list of elements using bubble sort<br>c) Write a JAVA program to sort for an element in a given list of elements using merge sort.<br>d) Write a JAVA program using StringBuffer to delete, remove character. |
| 3 | **Exercise - 3** (Class, Objects)<br>a) Write a JAVA program to implement class mechanism. Create a class, methods and invoke them inside main method.<br>b) Write a JAVA program to implement constructor. |
| 4 | **Exercise - 4** (Methods)<br>a) Write a JAVA program to implement constructor overloading.<br>b) Write a JAVA program implement method overloading. |
| 5 | **Exercise - 5** (Inheritance)<br>a) Write a JAVA program to implement SingleInheritance<br>b) Write a JAVA program to implement multi level Inheritance<br>c) Write a java program for abstract class to find areas of different shapes |
| 6 | **Exercise - 6** (Inheritance - Continued)<br>a) Write a JAVA program give example for –super‖ keyword.<br>b) Write a JAVA program to implement Interface. What kind of Inheritance can be achieved? |
| 7 | **Exercise - 7** (Exception)<br>a) Write a JAVA program that describes exception handling mechanism<br>b) Write a JAVA program Illustrating Multiple catch clauses |
| 8 | **Exercise – 8 (**Runtime Polymorphism)<br>a) Write a JAVA program that implements Runtime polymorphism<br>b) Write a Case study on run time polymorphism, inheritance that implements in above problem |
| 9 | **Exercise – 9** (User defined Exception)<br>a) Write a JAVA program for creation of Illustrating throw<br>b) Write a JAVA program for creation of Illustrating finally<br>c) Write a JAVA program for creation of Java Built-in Exceptions<br>d) d)Write a JAVA program for creation of User Defined Exception |
| 10 | **Exercise – 10** (Threads)<br>a) Write a JAVA program that creates threads by extending Thread class .First thread display |

| | |
|---|---|
| | -Good Morning -every 1 sec, the second thread displays -Hello -every 2 seconds and the third display -Welcome every 3 seconds ,(Repeat the same by implementing Runnable)<br>**b)** Write a program illustrating **isAlive** and **join ()**<br>**c)** Write a Program illustrating Daemon Threads. |
| **11** | **Exercise - 11** (Threads continuity)<br>a) Write a JAVA program Producer Consumer Problem<br>b) Write a case study on thread Synchronization after solving the above producer consumer problem |
| **12** | **Exercise – 12** (Packages)<br>a) Write a JAVA program illustrate class path<br>b) Write a case study on including in class path in your os environment of your package.<br>c) Write a JAVA program that import and use the defined your package in the previous Problem |
| **13** | **Exercise - 13** (Applet)<br>a) Write a JAVA program to paint like paint brush in applet.<br>b) Write a JAVA program to display analog clock using Applet.<br>c) Write a JAVA program to create different shapes and fill colors using Applet. |
| **14** | **Exercise - 14** (Event Handling)<br>a) Write a JAVA program that display the x and y position of the cursor movement using Mouse.<br>b) Write a JAVA program that identifies key-up key-down event user entering text in a Applet. |
| **15** | **Exercise-15** (AWT & Swings)<br>a) Write a Java Program to create a frame with three buttons and Radio Button<br>b) Write a Java Program to print text in different colors<br>c) Write a JAVA program that to create a single ball bouncing inside a JPanel. |
| **16** | **Exercise-16** (JDBC)<br>a) Write a Java program to Connect database<br>b) Write a Java Program to insert, update, delete & select records |

| **TEXT BOOKS** | |
|---|---|
| **1.** | JAVA one step ahead, Anitha Seth, B.L.Juneja, Oxford. |
| **2.** | The complete Reference Java, 8th edition, Herbert Schildt, TMH. |
| **REFERENCE BOOKS** | |
| **1.** | Introduction to java programming, 7th edition by Y Daniel Liang, Pearson |
| **2.** | Murach's Java Programming, Joel Murach |
| **WEB RESOURCES** | |
| **1.** | https://nptel.ac.in/courses/106/105/106105191/ |
| **2.** | https://www.w3schools.com/java/java_data_types.asp |

# PRAGATI ENGINEERING COLLEGE
## (Autonomous)
### B.Tech
### Computer Science and Engineering (Artificial Intelligence & Machine Learning)

**R-20**

## Skill Oriented Course

## Applications of Python-Numpy & Pandas

**Common to CSE(AI&ML) and CSE(AI)**

| | | | |
|---|---|---|---|
| **Course Category** | **Skill Oriented Course** | **Course Code** | 20CS4S07 |
| **Course Type** | Laboratory | **L-T-P-C** | 0-0-4-2 |
| **Prerequisites** | | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 00<br>50<br>50 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To understand the fundamentals of the Pandas library in Python and how it is used to handle data and also develop basic skills in data analysis and visualization |

| **COURSE OUTCOMES** | | **BTL** |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | |
| **CO1** | Analyze how data is collected, managed and stored for processing | K4 |
| **CO2** | Work with arrays, queries, and dataframes | K3 |
| **CO3** | Query DataFrame structures for cleaning and processing and manipulating files. Understand best practices for creating basic charts | K3 |

**Note:** K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

| | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO1 0** | **PO1 1** | **PO1 2** | **PS O1** | **PS O2** | **PS O3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 3 | 3 | 3 | - | - | - | - | - | 1 | - | 3 | 3 | 3 |
| **CO2** | 3 | 2 | 3 | 3 | 3 | - | - | - | - | - | 1 | - | 3 | 3 | 3 |
| **CO3** | 3 | 2 | 3 | 3 | 3 | - | - | - | - | - | 1 | - | 3 | 3 | 3 |

| COURSE CONTENT | |
|---|---|
| **1** | NumPy Installation using different scientific python distributions( Anaconda, Python(x,y), WinPython, Pyzo) |
| **2** | NumPy Basics (np.array, np.arrange, np.linespace, np.zeros, np.ones, np.random.random, np.empty) |
| **3** | Arrays ( array.shape, len(array), array.ndim, array.dtype, array.astype(type), type(array)) |
| **4** | Array Manipulation (np.append, np.insert, np.resize, np.delete, np.concatenate, np.vstack, np.hstack) |
| **5** | Mathematical Operations( np.add, np.substract, np.divide, np.multiply, np.sqrt, np.sin, np.cos, np.log, np.dot, np.roots) , Statistical Operations( np.mean, np.median, np.std, array.corrcoef( ) ) |
| **6** | NumPy data types |
| **7** | **Pandas Data Series:**<br>1) Write a Pandas program to create and display a one-dimensional array-like object containing an array of data using Pandas module.<br>2) Write a Pandas program to convert a Panda module Series to Python list and it's type.<br>3) Write a Pandas program to add, subtract, multiple and divide two Pandas Series.<br>4) Write a Pandas program to convert a NumPy array to a Pandas series.<br>Sample Series:<br>NumPy array:<br>[10 20 30 40 50]<br>Converted Pandas series:<br>0 10<br>1 20<br>2 30<br>3 40<br>4 50<br>dtype: int64 |
| **8** | **Pandas Data Frames:**<br>Consider Sample Python dictionary data and list labels:<br>exam_data = {'name': ['Anastasia', 'Dima', 'Katherine', 'James', 'Emily', 'Michael', 'Matthew', 'Laura', 'Kevin', 'Jonas'],<br>'score': [12.5, 9, 16.5, np.nan, 9, 20, 14.5, np.nan, 8, 19],<br>'attempts': [1, 3, 2, 3, 2, 3, 1, 1, 2, 1],<br>'qualify': ['yes', 'no', 'yes', 'no', 'no', 'yes', 'yes', 'no', 'no', 'yes']}<br>labels = ['a', 'b', 'c', 'd', 'e', 'f', 'g', 'h', 'i', 'j']<br>1) Write a Pandas program to create and display a DataFrame from a specified dictionary data which has the index labels.<br>2) Write a Pandas program to change the name 'James' to 'Suresh' in name column of the DataFrame.<br>3) Write a Pandas program to insert a new column in existing DataFrame.<br>4) Write a Pandas program to get list from DataFrame column headers.<br>5) Write a Pandas program to get list from DataFrame column headers. |

| | |
|---|---|
| **9** | **Pandas Index:**<br>1) Write a Pandas program to display the default index and set a column as an Index in a given dataframe.<br>2) Write a Pandas program to create an index labels by using 64-bit integers, using floating-point numbers in a given dataframe. |
| **10** | **Pandas String and Regular Expressions:**<br>1) Write a Pandas program to convert all the string values to upper, lower cases in a given pandas series. Also find the length of the string values.<br>2) Write a Pandas program to remove whitespaces, left sided whitespaces and right sided whitespaces of the string values of a given pandas series.<br>3) Write a Pandas program to count of occurrence of a specified substring in a DataFrame column.<br>4) Write a Pandas program to swap the cases of a specified character column in a given DataFrame. |
| **11** | **Pandas Joining and merging DataFrame:**<br>1) Write a Pandas program to join the two given dataframes along rows and assign all data.<br>2) Write a Pandas program to append a list of dictioneries or series to a existing DataFrame and display the combined data.<br>3) Write a Pandas program to join the two dataframes with matching records from both sides where available. |
| **12** | **Plotting:**<br>1) Write a Pandas program to create a horizontal stacked bar plot of opening, closing stock prices of any stock dataset between two specific dates.<br>2) Write a Pandas program to create a histograms plot of opening, closing, high, low stock prices of stock dataset between two specific dates.<br>3) Write a Pandas program to create a stacked histograms plot of opening, closing, high, low stock prices of stock dataset between two specific dates with more bins. |


| **TEXT BOOKS** | |
|---|---|
| 1. | Wes McKinney, Python for Data Analysis, O_Reilly, 2nd Edition, 2017. |
| **REFERENCE BOOKS** | |
| 1. | Sinan Ozdemir, Principles of Data Science, Packt Publishers, 2nd Edition, 2018 |
| 2. | John Paul Mueller, Luca Massaron, Python for Data Science for Dummies, 2nd Edition, Wiley, 2015. |
| 3. | Rachel Schutt, Cathy O_Neil, Doing Data Science: Straight Talk from the Frontline, O_Reilly, 2014. |
| **WEB RESOURCES** | |

| | |
|---|---|
| 1. | https://swayam.gov.in/nd1_noc19_cs60/preview |
| 2. | https://towardsdatascience.com |
| 3. | https://www.w3schools.com/datascience |
| **4.** | https://github.com/jakevdp/PythonDataScienceHandbook |
| **5.** | https://www.kaggle.com |

# PRAGATI ENGINEERING COLLEGE
## (Autonomous)
## B.Tech
## Computer Science and Engineering (Artificial Intelligence & Machine Learning)

**R-20**

# Automata Theory & Compiler Design

**Common to CSE, CSE(AI&ML), CSE(AI), CSE(DS) & IT**

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 20IT4T05 |
| **Course Type** | Theory | **L-T-P-C** | 3 – 0 – 0 – 3 |
| **Prerequisites** | | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

**COURSE OBJECTIVES**

| | |
|---|---|
| **1** | To learn fundamentals of Regular and Context Free Grammars and Languages |
| **2** | To understand the relation between Contexts free Languages, PDA and TM |
| **3** | To study the various phases in the design of a compiler |
| **4** | To understand the design of top-down and bottom-up parsers |
| **5** | To understand syntax directed translation schemes |
| **6** | To learn to develop algorithms to generate code for a target machine |

**COURSE OUTCOMES**

| **Upon successful completion of the course, the student will be able to:** | | **Cognitive Level** |
|---|---|---|
| **CO1** | Design DFA and NFA to accept given languages | K3 |
| **CO2** | Able to use LEX and YACC tools for developing a scanner and a parser and to design and implement LL and LR parsers | K3 |
| **CO3** | Able to design SDT | K3 |
| **CO4** | Able to design algorithms to perform code optimization in order to improve the performanceof a program in terms of space and time complexity | K3 |
| **CO5** | Ability to design algorithms to generate machine code | K3 |

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

**Contribution of Course Outcomes towards achievement of Program :**
**Outcomes (1 – Low, 2 - Medium, 3 – High)**

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

| COURSE CONTENT | |
|---|---|
| **UNIT I** | **Formal Language and Regular Expressions:** Languages, Definition Languages regular expressions, Finite Automata – DFA, NFA. Conversion of regular expression to NFA, NFA to DFA. Applications of Finite Automata to lexical analysis, lex tools. |
| **UNIT II** | **Context Free grammars and parsing :** Context free grammars, derivation, parse trees, ambiguity LL(K) grammars and LL(1) parsing Bottom up parsing handle pruning LR Grammar Parsing, LALR parsing, parsing ambiguous grammars, YACC programming specification. |
| **UNIT III** | **Semantics:** Syntax directed translation, S-attributed and L-attributed grammars, Intermediate code – abstract syntax tree, translation of simple statements and controlflow statements.<br>**Context Sensitive features –** Chomsky hierarchy of languages and recognizers. Type checking, type conversions, equivalence of type expressions, overloading of functions and operations. |
| **UNIT IV** | **Run time storage:** Storage organization, storage allocation strategies scope access tonow local names, parameters, language facilities for dynamics storage allocation.<br>**Code optimization:** Principal sources of optimization, optimization of basic blocks,peephole optimization, flow graphs, Data flow analysis of flow graphs. |
| **UNIT V** | **Code generation:** Machine dependent code generation, object code forms, generic codegeneration algorithm, Register allocation and assignment. Using DAG representation of Block. |
| **TEXTBOOKS** | |
| **1.** | Introduction to Automata Theory, Languages and Computation, J. E. Hopcroft, R. Motwani and J. D. Ullman, 3rd Edition, Pearson, 2008. |
| **2.** | Compilers Principles, Techniques and Tools Aho, Ullman, Ravisethi, Pearson Education. |
| **REFERENCE BOOKS** | |
| **1.** | Compilers Principles, Techniques and Tools Aho, Ullman, Ravisethi, Pearson Education. |
| **2.** | Tremblay J P, Sorenson G P: "The Theory & Practice of Compiler writing", 1st Edition, BSP publication, 2010. |
| **3.** | Theory of Computation, V. Kulkarni, Oxford University Press, 2013 |
| **WEB RESOURCES** | |
| **1.** | https://nptel.ac.in/courses/106/104/106104028/ |
| **2.** | https://nptel.ac.in/courses/106/104/106104123/ |

# PRAGATI ENGINEERING COLLEGE
## (Autonomous)
### B.Tech
### Computer Science and Engineering (Artificial Intelligence & Machine Learning)

**R-20**

# Operating Systems

**Common to CSE, CSE(AI&ML), CSE(AI), CSE(DS) & IT**

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 20IT4T04 |
| **Course Type** | Theory | **L-T-P-C** | 3 – 0 – 0 – 3 |
| **Prerequisites** | | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

**COURSE OBJECTIVES**

| | |
|---|---|
| **1** | Introduce to the internal operation of modern operating systems |
| **2** | Define, explain, processes and threads, mutual exclusion, CPU scheduling, deadlock, memory management, and file systems |
| **3** | Understand File Systems in Operating System like UNIX/Linux and Windows |
| **4** | Understand Input Output Management and use of Device Driver and Secondary Storage(Disk) Mechanism |
| **5** | Analyze Security and Protection Mechanism in Operating System |

**COURSE OUTCOMES**

| **Upon successful completion of the course, the student will be able to:** | | **Cognitive Level** |
|---|---|---|
| **CO1** | Describe various generations of Operating System and functions of Operating System | K2 |
| **CO2** | Comprehend the concept of program, process and thread and compare various CPU Scheduling Algorithms and Inter Process Communication problems | K2 |
| **CO3** | Compare various Memory Management Schemes especially paging and Segmentation in Operating System and apply various Page Replacement Techniques | K2 |
| **CO4** | Apply process synchronization techniques to avoid deadlocks | K3 |
| **CO5** | Outline File Systems in Operating System like UNIX/Linux and Windows | K2 |

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

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

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

| **COURSE CONTENT** | |
|---|---|
| **UNIT I** | Operating Systems Overview: Operating system functions, Operating system structure, Operating systems operations, Computing environments, Open-Source Operating Systems. System Structures: Operating System Services, User and Operating-System Interface, systems calls, Types of System Calls, system programs, operating system structure, operating system debugging, System Boot. |
| **UNIT II** | Process Concept: Process scheduling, Operations on processes, Inter-process communication, Communication in client server systems. Multithreaded Programming: Multithreading models, Thread libraries, Threading issues. Process Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling, Thread scheduling. Inter-process Communication: Race conditions, Critical Regions, Mutual exclusion with busy waiting, Sleep and wakeup, Semaphores, Mutexes, Monitors, Message passing, Barriers, Classical IPC Problems - Dining philosophers problem, Readers and writers problem |
| **UNIT III** | Memory-Management Strategies: Introduction, Swapping, Contiguous memory allocation, Paging, Segmentation. Virtual Memory Management: Introduction, Demand paging, Copy on-write, Page replacement, Frame allocation, Thrashing, Memory-mapped files, Kernel memory allocation. |
| **UNIT IV** | Deadlocks: Resources, Conditions for resource deadlocks, Ostrich algorithm, Deadlock detection and recovery, Deadlock avoidance, Deadlock prevention. File Systems: Files, Directories, File system implementation, management and optimization. Secondary- Storage Structure: Overview of disk structure, and attachment, Disk scheduling, RAID structure, Stable storage implementation. |
| **UNIT V** | System Protection: Goals of protection, Principles and domain of protection, Access matrix, Access control, Revocation of access rights. System Security: Introduction, Program threats, System and network threats, Cryptography for security, User authentication, Implementing security defenses, Firewalling to protect systems and networks, Computer security classification. Case Studies: Linux, Microsoft Windows. |

| **TEXTBOOKS** | |
|---|---|
| **1.** | Silberschatz A, Galvin P B, and Gagne G, Operating System Concepts, 9th edition, Wiley, 2013. |
| **2.** | Tanenbaum A S, Modern Operating Systems, 3rd edition, Pearson Education, 2008. (for Interprocess Communication and File systems.) |
| **REFERENCE BOOKS** | |
| **1.** | Dhamdhere D M, Operating Systems A Concept Based Approach, 3rd edition, Tata McGraw-Hill, 2012. |
| **2.** | Stallings W, Operating Systems - Internals and Design Principles, 6th edition, Pearson Education, 2009 |
| **3.** | Nutt G, Operating Systems, 3rd edition, Pearson Education, 2004. |
| **WEB RESOURCES** | |
| **1.** | https://nptel.ac.in/courses/106/105/106105214/ |

# PRAGATI ENGINEERING COLLEGE
## (Autonomous)
## B.Tech
## Computer Science and Engineering (Artificial Intelligence & Machine Learning)

**R-20**

**Machine Learning**

**CSE ( AI ML)**

**Common to CSE(AI&ML), CSE(AI), CSE(DS)**

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 20AM5T02 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | Probability and Statistics | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **The student will:** | |
| **1** | Identify problems that are amenable to solution by ANN methods, and which ML methodsmay be suited to solving a given problem. |
| **2** | Formalize a given problem in the language/framework of different ANN methods (e.g., as a search problem, as a constraint satisfaction problem, as a planning problem, as a Markovdecision process, etc). |

| **COURSE OUTCOMES** | | |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | **Cognitive Level** |
| **CO1** | Explain the fundamental usage of the concept Machine Learning system. | K1 |
| **CO2** | Demonstrate on various regression Technique. | K2 |
| **CO3** | Analyze the Ensemble Learning Methods. | K3 |
| **CO4** | Illustrate the Clustering Techniques and Dimensionality Reduction Models in Machine Learning. | K3 |
| **CO5** | Discuss the Neural Network Models and Fundamentals concepts of DeepLearning. | K3 |

**K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.**

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

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

| COURSE CONTENT | |
|---|---|
| **UNIT-I** | **Introduction**- Artificial Intelligence, Machine Learning, Deep learning, Types of Machine Learning Systems, Main Challenges of Machine Learning.<br>Statistical Learning: Introduction, Supervised and Unsupervised Learning, Training and Test Loss, Tradeoffs in Statistical Learning, Estimating Risk Statistics, Sampling distribution of an estimator, Empirical Risk Minimization. |
| **UNIT-II** | **Supervised Learning**: (Regression/Classification):Basic Methods: Distance based Methods, Nearest Neighbours, Decision Trees, Naive Bayes.<br>Linear Models: Linear Regression, Logistic Regression, Generalized Linear Models, Support Vector Machines. Binary Classification: Multiclass/Structured outputs, MNIST, Ranking. |
| **UNIT-III** | **Ensemble Learning and Random Forests**: Introduction, Voting Classifiers, Bagging and Pasting, Random Forests, Boosting, Stacking.<br>Support Vector Machine: Linear SVM Classification, Nonlinear SVM Classification SVM Regression, Naïve Bayes Classifiers. |
| **UNIT-IV** | **Unsupervised Learning Techniques**: Clustering, K-Means, Limits of K-Means, Using Clustering for Image Segmentation, Using Clustering for Preprocessing, Using Clustering for Semi-Supervised Learning, DBSCAN, Gaussian Mixtures.<br>**Dimensionality Reduction**: The Curse of Dimensionality, Main Approaches for Dimensionality Reduction, PCA, Using Scikit-Learn, Randomized PCA, Kernel PCA. |
| **UNIT-V** | **Neural Networks**: Introduction to Artificial Neural Networks with Keras, Implementing MLPs with Keras, Installing TensorFlow 2, Loading and Preprocessing Data with TensorFlow. |

| TEXT BOOKS | |
|---|---|
| **1.** | "Machine Learning" , Tom M. Mitchell, Tata Mc – Graw Hill Publications, 2nd Edition, 2021 |
| **2.** | Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Edition, O'ReillyPublications, 2019. |
| **REFERENCE BOOKS** | |
| **1.** | Data Science and Machine Learning Mathematical and Statistical Methods,Dirk P. Kroese,Zdravko I. Botev, Thomas Taimre, Radislav Vaisman,25th November 2020. |
| **2.** | Machine Learning Probabilistic Approach, Kevin P. Murphy, MIT Press, 2012. |
| **WEB RESOURCES:** | |
| **1** | https:// https://onlinecourses.nptel.ac.in/noc21-cs24/preview |

# PRAGATI ENGINEERING COLLEGE
## (Autonomous)
### B.Tech
### Computer Science and Engineering (Artificial Intelligence & Machine Learning)

**R-20**

## Open Elective-I

## Surveying

| | | | |
|---|---|---|---|
| **Course Category** | Open Elective | **Course Code** | 20CE5T01 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | ---------- | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| 1 | Introduce the students to basic principles of surveying. |
| 2 | Demonstrate the basic surveying skills. |
| 3 | Perform various methods of linear and angles measurements. |
| 4 | Enable the students to use surveying equipment's |
| 5 | Integrate the knowledge and produce topographical map. |

| **COURSE OUTCOMES** | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Illustrate the fundamentals in chain and plane table surveying. |
| **CO2** | Identify the angles on filed by compass survey. |
| **CO3** | Apply knowledge of leveling in surveying. |
| **CO4** | Measure the horizontal and vertical angles by using Theodolite and Total Station instruments. |
| **CO5** | Estimate the volume and area of irregular boundaries of filed. |

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

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

| COURSE CONTENT | |
|---|---|
| **UNIT I** | **INTRODUCTION:** Definition-Uses of surveying, Objectives, Principles and Classificationsof Surveying – Errors in survey measurements. **DISTANCEMEASUREMENTCONVENTIONS AND METHODS:** Use of chain and tape, Errors and corrections to linear measurements, overview of plane table surveying. |
| **UNIT II** | **COMPASS SURVEY:** Definition- Principles of Compass survey - Meridians, Azimuths and Bearings, declination. Computation of angle - Purpose and types of Traversing - traverse adjustments – Local attraction. |
| **UNIT III** | **LEVELING:** Concept and Terminology, Levelling Instruments and their Temporary and permanent adjustments- method of levelling. **CONTOURING:** Characteristics and uses of contours- methods of conducting contour surveys and their plotting. |
| **UNIT IV** | **THEODOLITE:** Theodolite, description, principles - uses – temporary and permanent adjustments, measurement of horizontal and vertical angles. Principles of Electronic Theodolite – Omitted Measurements. Introduction to geodetic surveying - Total Station and Global Positioning System. **CURVES:** Types of curves, design and setting out. **TACHEOMETRIC SURVEYING:** Stadia and tangential methods of Tachometry. **MODERN SURVEYING METHODS:** Principle and types of E.D.M. Instruments, Totalstation advantages and Applications. Introduction to Global Positioning System. |
| **UNIT V** | **COMPUTATION OF AREAS AND VOLUMES:** Computation of areas along irregular boundaries and regular boundaries. Embankments and cutting for a level section and two- level sections with and without transverse slopes, determination of the capacity of reservoir, volume of barrow pits. |

| TEXT BOOKS | |
|---|---|
| **1.** | Surveying (Vol No.1, 2 &3) by B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain – Laxmi Publications (P) ltd, New Delhi. |
| **2.** | Text book of Surveying by C. Venkataramaiah, University press, India (P) limited. |
| **REFERENCE BOOKS** | |
| **1.** | Text book of Surveying by S.K. Duggal (Vol No. 1&2), Tata McGraw Hill Publishing Co. Ltd. New Delhi. |
| **2.** | Text book of Surveying by Arora (Vol No. 1&2), Standard Book House, Delhi. |
| **WEB RESOURCES** | |
| **1.** | https://lecturenotes.in/notes/2827-note-for-surveying-1-s-1-by-swadhina-priyadarsini |
| **2.** | https://nptel.ac.in/courses/105107122/1 |
| **3.** | https://nptel.ac.in/courses/105107158/ |

# Renewable Energy Engineering

| | | | |
|---|---|---|---|
| **Course Category** | Open Elective | **Course Code** | 20EE5T13 |
| **Course Type** | Theory | **L-T-P-C** | **3-0-0-3** |
| **Prerequisites** | **NIL** | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | **30**<br>**70**<br>**100** |

**5.**

| **COURSE OBJECTIVES** | |
|---|---|
| 1 | To study the solar radiation data, equivalent circuit of PV cell and its I-V & P-V characteristics |
| 2 | To understand the concept of Wind Energy Conversion & its applications |
| 3 | To study the principles of biomass and geothermal energy |
| 4 | To understand the principles of Ocean Thermal Energy Conversion (OTEC), motion of waves and power associated with it |
| 5 | To study the various chemical energy sources such as fuell cell and hydrogen energy along with their operation and equivalent circuit |

| **COURSE OUTCOMES** | | |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | **Cognitive Level** |
| CO1 | Analyze solar radiation data, extra-terrestrial radiation, radiation on earth‘s surface and solar Energy Storage | K4 |
| CO2 | Illustrate the components of wind energy systems | K3 |
| CO3 | Illustrate the working of biomass, digesters and Geothermal plants | K3 |
| CO4 | Demonstrate the principle of Energy production from OTEC, Tidal and Waves | K3 |
| CO5 | Evaluate the concept and working of Fuel cells & MHD power generation | K4 |
| K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create | | |

| **Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)** | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |
| **CO1** | 3 | 2 | 1 | 1 | - | - | 1 | - | - | - | - | 1 | 2 | 2 |
| **CO2** | 3 | 2 | 1 | 1 | - | - | 1 | - | - | - | - | 1 | 2 | 2 |
| **CO3** | 3 | 1 | 1 | 1 | - | - | 1 | - | - | - | - | 1 | 2 | 2 |
| **CO4** | 3 | 1 | 1 | 1 | - | - | 1 | - | - | - | - | 1 | 2 | 2 |
| **CO5** | 3 | 1 | 1 | 1 | - | - | 1 | - | - | - | - | 1 | 2 | 2 |

| COURSE CONTENT | |
|---|---|
| **UNIT 1** | **Solar Energy:** Introduction - Renewable Sources - prospects, Solar radiation at the Earth Surface - Equivalent circuit of a Photovoltaic (PV) Cell - I-V & P-V Characteristics - Solar Energy Collectors: Flat plate Collectors, concentrating collectors - Solar Energy storage systems and Applications: Solar Pond - Solar water heating - Solar Green house. |
| **UNIT 2** | **Wind Energy**: Introduction - basic Principles of Wind Energy Conversion, the nature of Wind - the power in the wind - Wind Energy Conversion - Site selection considerations - basic components of Wind Energy Conversion Systems (WECS) - Classification - Applications. |
| **UNIT 3** | **Biomass and Geothermal Energy:**<br>**Biomass:** Introduction - Biomass conversion technologies - Photosynthesis, factors affecting Bio digestion - classification of biogas plants - Types of biogas plants - selection of site for a biogas plant<br>**Geothermal Energy**: Introduction, Geothermal Sources – Applications - operational and Environmental problems. |
| **UNIT 4** | **Energy From oceans, Waves & Tides:**<br>**Oceans:** Introduction - Ocean Thermal Electric Conversion (OTEC) – methods - prospects of OTEC in India.<br>**Waves:** Introduction - Energy and Power from the waves - Wave Energy conversion devices.<br>**Tides:** Basic principle of Tide Energy -Components of Tidal Energy. |
| **UNIT 5** | **Chemical Energy Sources:**<br>**Fuel Cells**: Introduction - Fuel Cell Equivalent Circuit - operation of Fuel cell - types of Fuel Cells - Applications.<br>**Hydrogen Energy:** Introduction - Methods of Hydrogen production - Storage and Applications<br>**Magneto Hydro Dynamic (MHD) Power generation:** Principle of Operation - Types. |

| **TEXT BOOKS** | |
|---|---|
| 1 | G.D.Rai, Non-Conventional Energy Sources, Khanna Publications, 2011 |
| 2 | John Twidell & Tony Weir, Renewable Energy Sources, Taylor & Francis, 2013 |
| **REFERENCE BOOKS** | |
| 1 | S.P.Sukhatme & J.K.Nayak, Solar Energy-Principles of Thermal Collection and Storage, TMH, 2011 |
| 2 | John Andrews & Nick Jelly, Energy Science- principles, Technologies and Impacts, Oxford, 2nd edition, 2013 |
| 3 | Shoba Nath Singh, Non- Conventional Energy Resources, Pearson Publications, 2015 |
| **WEB RESOURCES (Suggested)** | |
| 1 | https://nptel.ac.in/courses/121/106/121106014/ |
| 2 | https://nptel.ac.in/courses/103/107/103107157/ |

# PRAGATI ENGINEERING COLLEGE
## (Autonomous)
### B.Tech
### Computer Science and Engineering (Artificial Intelligence & Machine Learning)

**R-20**

# Optimization Techniques

| | | | |
|---|---|---|---|
| **Course Category** | Open Elective | **Course Code** | 20ME5T29 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | NIL | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| To make the students learn about | |
| **1** | Classical optimization techniques |
| **2** | Numerical methods for optimization |
| **3** | Genetic algorithm and Genetic programming |
| **4** | Multi-Objective Genetic algorithm |
| **5** | Optimization in design and manufacturing systems |

| **COURSE OUTCOMES** | | |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | **Cognitive Level** |
| **CO1** | Analyze the Classical optimization techniques for single and multi-variable problems with and with and without constraints. | K4 |
| **CO2** | Apply numerical methods for optimization of manufacturing related problems | K3 |
| **CO3** | Apply the Principles of genetic algorithm and genetic programming to manufacturing related problems | K3 |
| **CO4** | Analyze the Multi-Objective Genetic algorithm for industrial problems | K4 |
| **CO5** | Solve engineering problems by using optimization techniques in design and manufacturing systems | K3 |

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

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

| COURSE CONTENT | |
|---|---|
| **UNIT I** | CLASSICAL OPTIMIZATION TECHNIQUES: Single variable optimization with and without constraints, multi – variable optimization without constraints, multi – variable optimization with constraints – method of Lagrange multipliers, Kuhn-Tucker conditions, merits and demerits of classical optimization techniques. |
| **UNIT II** | NUMERICAL METHODS FOR OPTIMIZATION: Nelder Mead‘s Simplex search method, Gradient of a function, Steepest descent method, Newton‘s method, Pattern search methods, conjugate method, types of penalty methods for handling constraints, advantages of numerical methods. |
| **UNIT III** | GENETIC ALGORITHM (GA): Differences and similarities between conventional and evolutionary algorithms, working principle, reproduction, crossover, mutation, termination criteria, different reproduction and crossover operators, GA for constrained optimization, draw backs of GA.<br>GENETIC PROGRAMMING (GP): Principles of genetic programming, terminal sets, functional sets, differences between GA & GP, random population generation, solving differential equations using GP. |
| **UNIT IV** | MULTI-OBJECTIVE GA: Pareto‘s analysis, non-dominated front, multi – objective GA, Non-dominated sorted GA, convergence criterion, applications of multi-objective problems. |
| **UNIT V** | APPLICATIONS OF OPTIMIZATION IN DESIGN AND MANUFACTURING SYSTEMS: Some typical applications like optimization of path synthesis of a four-bar mechanism, minimization of weight of a cantilever beam, optimization of springs and gears, general optimization model of a machining process, optimization of arc welding parameters, and general procedure in optimizing machining operations sequence. |

| TEXT BOOKS | |
|---|---|
| **1.** | Engineering Optimization Theory & Practice, Singiresu S. Rao New Age International Publishers, Ltd. |
| **2.** | Optimization for Engineering Design, Kalyanmoy Deb, PHI Publishers. |

| REFERENCE BOOKS | |
|---|---|
| **1.** | Genetic algorithms in Search, Optimization, and Machine learning, D.E.Goldberg, Addison-Wesley Publishers |
| **2.** | Multi objective Genetic algorithms, Kalyanmoy Deb, PHI Publishers |
| **3.** | Optimal design, Jasbir Arora, Mc Graw Hill (International) Publishers |
| **4.** | Optimum Design of Mechanical Elements, Ray C. Johnson, John Wiley & sons, Inc., New York. |

| WEB REFERENCES | |
|---|---|
| **1.** | https://nptel.ac.in/courses/111/105/111105039/ |
| **2.** | https://nptel.ac.in/courses/106/108/106108056/ |
| **3.** | https://nptel.ac.in/courses/112/105/112105235/ |
| **4.** | https://onlinecourses.nptel.ac.in/noc21_me43/preview |
| **5.** | https://www.nptel.ac.in/content/syllabus_pdf/112103301.pdf |

# PRAGATI ENGINEERING COLLEGE
## (Autonomous)
### B.Tech
### Computer Science and Engineering (Artificial Intelligence & Machine Learning)

**R-20**

## Entrepreneurship

| | | | |
|---|---|---|---|
| **Course Category** | Open Elective Core | **Course Code** | 20HM5T03 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | | **Internal Assessment Semester End Examination Total Marks** | 30<br>70<br>100 |

| **COURSE OUTCOMES** | | |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | **Cognitive Level** |
| **CO1** | Understand the meaning and importance of Organizational Behaviour to start and survive in corporate environment. | K2 |
| **CO2** | Demonstrate how the perception can integrate in human behaviour , attitudes and values. | K1 |
| **CO3** | Understand the importance of Groups and Teams in organizations for better Decision making. | K2 |
| **CO4** | Understand the need for change and its importance in organizations. | K2 |
| **CO5** | Understand the culture of organizations and to apply techniques in dealing with stress in organizations. | K2 |

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | -- | -- | -- | -- | -- | 1 | -- | 2 | 2 | 2 | -- | 2 |
| **CO2** | -- | -- | -- | -- | -- | 1 | -- | 3 | 2 | 3 | -- | 2 |
| **CO3** | -- | -- | -- | -- | -- | 1 | -- | 2 | 3 | 3 | -- | 2 |
| **CO4** | -- | -- | -- | -- | -- | 1 | -- | 3 | 3 | 2 | -- | 2 |
| **CO5** | -- | -- | -- | -- | -- | 3 | -- | 1 | 2 | 2 | -- | 2 |

| COURSE CONTENT | |
|---|---|
| **UNIT-I** | **Introduction to Organizational Behaviour**<br>Concept-Nature and scope-Importance of Organizational Behaviour-Key elements of Organizational Behaviour-Role of managers in Organizational Behaviour-Approaches to Organizational Behaviour-Perspectives of Human Behaviour-Challenges and Opportunities for Organizational Behaviour. |
| **UNIT-II** | **Perceptual Management**<br>Nature-Process of Perception- Organization and Interpretation-Influencing factors-Importance of Perception in OB - Perceptual Errors- Attitudes and Values –Changes and Behaviour Modification Techniques-Impression Management |
| **UNIT-III** | **Introduction to Groups and Teams**<br>Meaning –Importance of Groups - Foundations of Group Behaviour –Reasons for Group formation-Group and Team-Types of Groups-Stages of Group development –Meaning and Importance of Teams- Factors affecting Group and Team performance-Types of teams-Creating an effective Team. |
| **UNIT-IV** | **Organization Change and Development**<br>Definition and Meaning - Need for change-Forces for changes in Organization-Types of change-Organizational Resistance-Strategies overcome Resistance-Process of change-Meaning and Definition of Organization Development-OD interventions. |
| **UNIT-V** | **Organizational Culture and Organizational Stress**<br>Organizational culture: Meaning and Nature of Organizational Culture-Functions-Types-Creating and maintain Organizational Culture-Managing Cultural Diversity. Organizational Stress: Definition and Meaning-Sources of stress-Impact of stress on organizations-Stress Management Techniques. |

| TEXT BOOKS | |
|---|---|
| **1.** | K.Aswathappa: "Organizational Behaviour-Text, Cases and Games", Himalaya Publishing House, New Delhi, 2017, |
| **2.** | Stephen P. Robbins, Timothy, A. Judge: "Essentials of Organizational Behaviour" Pearson,2017. |
| **REFERENCE BOOKS** | |
| **1.** | Pareek Udai, Sushma Khanna: "Understanding Organizational Behaviour", Oxford University Press, New Delhi, 2016. |
| **2.** | Luthans, Fred: Organizational Behaviour 10/e, McGraw-Hill, 2015 |
| **3.** | Steven L McShane, Mary Ann Von Glinow, Radha R Sharma: "Organizational Behavior", Tata McGraw Hill Education, New Delhi, 2017.. |
| **4.** | Jerald Greenberg and Robert A Baron: "Behavior in Organizations", PHI Learning Private Limited, New Delhi, 2013. |
| **5.** | Jerald Greenberg and Robert A Baron: "Behavior in Organizations", PHI Learning Private Limited, New Delhi, 2013. |
| **WEB RESOURCES:** | |
| **1** | https://www.diversityresources.com/cultural-diversity-workplace/ |
| **2** | https://www.chanty.com/blog/problem-solving-techniques/ |
| **3** | https://theintactone.com/2019/06/18/mpob-u3-topic-6-perception-process-and-errors |

# Professional Elective – I

## Software Engineering

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 20CS4T08 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | Data Structures | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | Give exposure to phases of Software Development, common process models including Waterfall, and the Unified Process, and hands-on experience with elements of the agile process |
| **2** | Give exposure to a variety of Software Engineering practices such as requirements analysis and specification, code analysis, code debugging, testing, traceability, and version control |
| **3** | Give exposure to Software Design techniques |

| **COURSE OUTCOMES** | | **BTL** |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | |
| **CO1** | Ability to transform an Object-Oriented Design into high quality, executable code | K3 |
| **CO2** | Skills to design, implement, and execute test cases at the Unit and Integration level | K3 |
| **CO3** | Compare conventional and agile software methods | K4 |
| **CO4** | Skills to design Software Architectural components. | K3 |
| **CO5** | Analyze the interface analysis and Testing strategies. | K4 |

**Note:** K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

| Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
| **CO1** | 3 | 3 | 2 | - | 3 | - | - | - | - | - | - | 1 | - | - | - |
| **CO2** | 3 | 3 | 2 | - | 2 | - | - | - | - | - | - | 1 | 2 | - | - |
| **CO3** | 3 | 2 | 1 | 3 | 2 | - | - | - | 2 | - | - | 2 | 3 | - | 3 |
| **CO4** | 3 | 2 | 3 | 2 | 3 | - | - | - | 2 | - | - | 2 | 3 | 3 | 3 |
| **CO5** | 3 | 3 | 3 | 2 | 3 | - | - | - | 2 | - | - | 3 | 3 | 3 | 3 |

| **COURSE CONTENT** | |
|---|---|
| **UNIT I** | The Nature of Software, The Unique Nature of WebApps, Software Engineering, The Software Process, Software Engineering Practice, Software Myths. A Generic Process Model, Process Assessment and Improvement, Prescriptive Process Models, Specialized Process Models, The Unified Process, Personal and Team Process Models, Process Technology. |
| **UNIT II** | Agility, Agility and the Cost of Change, Agile Process, Extreme Programming (XP), Other Agile Process Models, A Tool Set for the Agile Process, Software Engineering Knowledge, Core Principles, Principles That Guide Each Framework Activity, Requirements Engineering, Establishing the Groundwork, Eliciting Requirements, Developing Use Cases, Building the Requirements Model, Negotiating Requirements, Validating Requirements. |
| **UNIT III** | Requirements Analysis, Scenario-Based Modeling, UML Models That Supplement the Use Case, Data Modeling Concepts, Class-Based Modeling, Requirements Modeling Strategies, Flow-Oriented Modeling, Creating a Behavioral Model, Patterns for Requirements Modelling, Requirements Modeling for WebApps. |
| **UNIT IV** | Design within the Context of Software Engineering, The Design Process, Design Concepts, The Design Model, Software Architecture, Architectural Genres, Architectural Styles, Assessing Alternative Architectural Designs, Architectural Mapping Using Data Flow, Components, Designing Class-Based Components, Conducting Component-Level Design, Component-Level Design for WebApps, Designing Traditional Components, Component-Based Development. |
| **UNIT V** | The Golden Rules, User Interface Analysis and Design, Interface Analysis, Interface Design Steps, WebApp Interface Design, Design Evaluation, Elements of Software Qualtiy Assurance, SQA Tasks, Goals & Metrics, Statistical SQA, Software Reliability, A Strategic Approach to Software Testing, Strategic Issues, Test Strategies for Conventional Software, Test Strategies for Object-Oriented Software, Test Strategies for WebApps, Validation Testing, System Testing, The Art of Debugging, Software Testing Fundamentals, Internal and External Views of Testing, White-Box Testing, Basis Path Testing. |

| | |
|---|---|
| **TEXT BOOKS** | |
| **1.** | Software Engineering a practitioner‘s approach, Roger S. Pressman, Seventh Edition, McGraw Hill Higher Education. |
| **2.** | Software Engineering, Ian Sommerville, Ninth Edition, Pearson. |
| **REFERENCE BOOKS** | |
| **1.** | Software Engineering, A Precise Approach, PankajJalote, Wiley India, 2010. |
| **2.** | Software Engineering, Ugrasen Suman, Cengage. |
| **WEB RESOURCES** | |
| **1.** | https://nptel.ac.in/courses/106/105/106105182/ |
| **2.** | https://nptel.ac.in/courses/106/105/106105182/ |
| **3.** | https://nptel.ac.in/courses/106/101/106101061/ |
| **4.** | https://www.coursera.org/learn/software-processes-and-agile-practices |
| **5.** | http://www.geeksforgeeks.org/software-engineering-gq/ |

# PRAGATI ENGINEERING COLLEGE
## (Autonomous)
### B.Tech
### Computer Science and Engineering (Artificial Intelligence & Machine Learning)

**R-20**

# Computer Vision

**Common to CSE and CSE (AI)**

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 20AI5T02 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | Transforms and Vector Calculus, Data Structures | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **The student will:** | |
| **1** | To introduce students the fundamentals of image formation |
| **2** | To introduce students the major ideas, methods, and techniques of computer vision and pattern recognition; |
| **3** | To develop an appreciation for various issues in the design of computer vision and object recognition systems |
| **4** | To provide the student with programming experience from implementing computer vision and object recognition applications. |

| **COURSE OUTCOMES** | | |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | **Cognitive Level** |
| **CO1** | Identify basic concepts, terminology, theories, models and methods in the field of computer vision. | K1 |
| **CO2** | Describe known principles of feature detection and matching | K2 |
| **CO3** | Identify, formulate and solve problems in image processing and computer vision | K1 |
| **CO4** | Describe basic methods of computer vision related to image stitching, photography like high dynamic range imaging and blur removal. | K2 |
| **CO5** | Suggest a design of a computer vision system for a 3D Reconstruction, Albedos, image based rendering views and depths. | K3 |

**K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.**

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

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

| COURSE CONTENT | |
|---|---|
| **UNIT-I** | **Introduction:** Image Formation: Geometric Primitives and Transformation, Photometric Image Formation, Digital Camera, Image Processing: Point Operators, Linear Filtering, More Neighborhood Operators, Fourier Transforms, Pyramids and Wavelets, Geometric Transformations, Global Optimization. |
| **UNIT-II** | **Feature Detection and Matching:** Points and Patches, Edges, Lines, Segmentation: Active Contours, Split and Merge, Mean Shift and Mode Finding, Normalized Cuts, Feature-Based Alignment: 2D and 3D Feature-based Alignment, Pose Estimation, Geometric Intrinsic Calibration. |
| **UNIT-III** | **Structure and Motion:** Triangular, Two-frame Structure from Motion, Factorization, Bundle Adjustment, Constrained Structure and Motion, Dense Motion Estimation: Translation Alignment, Parametric Motion, Spline-based Motion, Optical Flow, Layered motion. |
| **UNIT-IV** | **Image Stitching:** Motion Models, Global Alignment, Composing, Computational Photography: Photometric Calibration, High Dynamic Range Imaging, Super-Resolution and Blur Removal, image Matting and Compositing, Texture Analysis and Synthesis. |
| **UNIT-V** | **3D Reconstruction:** Shape From X, Active Range Finding, Surface Representation, Point-based Representation, Volumetric Representation, Model-based Reconstruction, Recovering Texture Maps and Albedos, Image- based Rendering: View Interpolation, Layered Depth Images, Light Fields and Lumigraphs, Environment Mattes, Video-based Rendering. |

| TEXT BOOKS | |
|---|---|
| **1.** | Richard Szeliski, Computer Vision: Algorithms and Applications, Springer-Verlag London Limited, 2011. |
| **2.** | Simon J.D Prince, Computer Vision: Models, Learning and Inference, 1st Edition, 2012. |
| **REFERENCE BOOKS** | |
| **1.** | Computer Vision - A modern approach, by D. Forsyth and J. Ponce, Prentice Hall Robot Vision, by B. K. P. Horn, McGraw-Hill. |
| **2.** | Haralick& Shapiro, “Computer and Robot Vision”, Vol II |
| **3.** | G_erardMedioni and Sing Bing Kang “Emerging topics in computer vision”75 |
| **WEB RESOURCES:** | |
| **1** | https://onlinecourses.nptel.ac.in/noc22_ee48/preview |

# Data Visualization Techniques

**Common to CSE(AI&ML), CSE(AI), CSE(DS)**

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | **20DS7T10** |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | Data Science through Python | **Internal Assessment<br>Semester End Examination<br>Total Marks** | **30<br>70<br>100** |

| **COURSEOBJECTIVES** | |
|---|---|
| **1** | Understand the visualization process and visual representations of data |
| **2** | Learn visualization techniques for various types of data. |
| **3** | Explore the visualization techniques for graphs, trees, Networks. |
| **4** | Understand the visualization of maps, GIS and collaborative visualizations. |
| **5** | Discuss the recent trends in perception and visualization techniques. |

| **COURSEOUTCOMES** | | **Cognitive level** |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | |
| **CO1** | Differentiate between Data Visualization and Infographics | K2 |
| **CO2** | Evaluate Data Visualizations | K3 |
| **CO3** | Apply various types of Visualizations | K3 |
| **CO4** | Develop basic programs using D3.js | K2 |
| **CO5** | Enumerate various Hierarchical patterns | K2 |

K1: Remember, K2: Understand, K3:Apply, K4:Analyze, K5:Evaluate, K6:Create.

**Contribution of Course Outcomes towards achievement of Program Outcomes (1–Low,2-Medium,3– High)**

| **CO** | **PO** | | | | | | | | | | | | **PSO** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** | **3** |
| **1** | 3 | 3 | 2 | 2 | 2 | - | - | - | - | - | - | - | 1 | 1 | 1 |
| **2** | 3 | 1 | 1 | 2 | 2 | - | - | - | - | - | - | 1 | - | - | 1 |
| **3** | 3 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | 1 | 2 | 2 | 1 |
| **4** | 3 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | 1 | 2 | 2 | 1 |
| **5** | 3 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | 1 | 2 | 2 | 1 |

| COURSE CONTENTS | |
|---|---|
| **UNIT I** | **Introducing Data Visualization:** Understanding Data Visualization, Recognizing the Traits of Good Data Viz, Embracing the Design Process, Ensuring Excellence in Your Data Visualization.<br>**Exploring Common Types of Data Visualizations:** Understanding the Difference between Data Visualization and Infographics, Picking the Right Content Type, Appreciating Interactive Data Visualizations, Observing Visualizations in Different Fields,<br>Using Dashboards, Discovering Infographics **(Text Book 1)** |
| **UNIT II** | **Mastering Basic Data Visualization Concepts**<br>**Using Charts Effectively:** Deciding Which Charts to Use and When to Use Them<br>**Adding a Little Context:** Making Text Useful, Exploring Text Analysis<br>**Evaluating Real Data Visualizations:** Analyzing Data Visualizations by Category, Evaluating Data Visualizations **(Text Book 1)** |
| **UNIT III** | **Defining an Easy-to-Follow Storyboard:** Business Intelligence Overview, Delving Into Your Story, Building Your First Storyboard. **Developing a Clear Mock-Up:** Getting Started with Your Mock-Up, Building Template Layouts.<br>**Adding Functionality and Applying Color:** Recognizing the Human Components, Dipping Into Color. **Exploring User Adoption:** Understanding User Adoption, Considering Five UA Measurements, Marketing to Data Viz Users. **(Text Book 1)** |
| **UNIT IV** | **D3.js fundamentals**<br>An introduction to D3.js, **How D3 works:** Data visualization is more than charts, D3 is about selecting and binding, D3 is about deriving the appearance of web page elements from bound data, **The power of HTML5:** The DOM, Coding in the console, SVG, CSS, JavaScript, Data standards: Tabular data, Nested data, Network data, Geographic data, Your first D3 app **(Text Book 2)** |
| **UNIT V** | **Layouts**:<br>Histograms, Pie charts, Stack layout, D3.js in the real world.<br>**Complex data Visualization**<br>**Hierarchical visualization:** Hierarchical patterns, Working with hierarchical data, Pack layouts, Trees, Partition, Treemaps. **(Text Book 2)** |

| TEXTBOOKS | |
|---|---|
| **1.** | Data Visualization For Dummies by Mico Yuk, Stephanie Diamond, John Wiley & Sons, Inc, 2014 |
| **2** | D3.js in Action, Elijah Meeks, Second Edition, Manning Publications, 2018 |

| REFERENCEBOOKS | |
|---|---|
| **1.** | Practical Python Data Visualization: A Fast Track Approach To Learning Data Visualization With Python by Ashwin Pajankar, Apress; 1st edition, 2020 |
| **2.** | Ossama Embarak, Data Analysis and Visualization Using Python: Analyze Data to Create Visualizations for BI Systems, Apress, 2018 |
| **3.** | **Visual Data Mining: Techniques and Tools for Data Visualization and Mining by Tom Soukup, Ian Davidson, John Wiley & Sons, Inc, 2002.** |

| WEBRESOURCES | |
|---|---|
| **2.** | ibm.com/analytics/data-visualization |
| **4.** | https://www.tibco.com/reference-center/guide-to-data-visualization |
| **5.** | https://ocw.mit.edu/courses/res-6-009-how-to-process-analyze-and-visualize-data-january-iap-2012/ |

# DevOps

## Common to IT, CSE(AI), CSE(AI&ML), CSE(DS)

| | | | |
|---|---|---|---|
| **Course Category** | Job Oriented | **Course Code** | 20IT5T07 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | **30**<br>**70**<br>**100** |

**COURSE OBJECTIVES**
The objective of the course is to

| | |
|---|---|
| **1** | DevOps improves collaboration and productivity by automating infrastructure and workflows and continuously measuring applications performance |

| **COURSE OUTCOMES** | | **Cognitive level** |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | |
| **CO1** | Enumerate the principles of continuous development and deployment, automation of configuration management, inter-team collaboration, and IT service agility. | K2 |
| **CO2** | Describe DevOps & DevSecOps methodologies and their key concepts. | K2 |
| **CO3** | ıstrate the types of version control systems, continuous integration tools, continuous monitoring tools, and cloud models. | K2 |
| **CO4** | t up complete private infrastructure using version control systems and CI/CD tools. | K2 |
| **CO5** | Know about DevOps maturity model. | K2 |

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 1 | 1 | 2 | 1 | 3 | - | - | - | - | - | - | - | 0 | 3 | 2 |
| **CO2** | 1 | 1 | 2 | 1 | 3 | - | - | - | - | - | - | - | 0 | 3 | 2 |
| **CO3** | 1 | 1 | 2 | 1 | 3 | - | - | - | - | - | - | - | 0 | 3 | 2 |
| **CO4** | 1 | 1 | 2 | 1 | 3 | - | - | - | - | - | - | - | 0 | 3 | 2 |
| **CO5** | 1 | 1 | 2 | 1 | 3 | - | - | - | - | - | - | - | 0 | 3 | 2 |

| COURSE CONTENT | |
|---|---|
| **UNIT I** | Phases of Software Development life cycle. Values and principles of agile software development. |
| **UNIT II** | **Fundamentals of DevOps**: Architecture, Deployments, Orchestration, Need, Instance of applications, DevOps delivery pipeline, DevOps eco system. |
| **UNIT III** | **DevOps adoption in projects**: Technology aspects, Agiling capabilities, Tool stack implementation, People aspect, processes. |
| **UNIT IV** | **CI/CD**: Introduction to Continuous Integration, Continuous Delivery and Deployment, Benefits of CI/CD, Metrics to track CICD practices |
| **UNIT V** | **DevOps Maturity Model**: Key factors of DevOps maturity model, stages of DevOps maturity model, DevOps maturity Assessment |

| TEXT BOOKS | |
|---|---|
| **1.** | The DevOps Handbook: How to Create World - Class Agility, Reliability, and Security in Technology Organizations is considered the DevOps bible. Gene Kim, Jez Humble, Patrick Debois, and John Willis |
| **2.** | Continuous Delivery: Reliable Software Releases Through Build, Test, and Deployment Automation, Jez Humble and David Farley |
| **3.** | Effective DevOps: Building A Culture of Collaboration, Affinity, and Tooling at Scale, Jennifer Davis & Ryn Daniels. |

| REFERENCE BOOKS | |
|---|---|
| **1.** | Httermann, Michael, “DevOps for Developers”, Apress Publication. |
| **2.** | Joakim Verona, “Practical DevOps”, Pack publication |

| WEB RESOURCES | |
|---|---|
| **1.** | https://www.udacity.com/course/intro-to-devops--ud611 - Good online course with sample exercises. |
| **2.** | http://www.edureka.co/devops - Online Training covering high level process and tools. (Needs Registration) |
| **3.** | https://www.edx.org/course?search_query=devops – Has no. of courses from MS and Redhat. |
| **4.** | https://www.codementor.io/devops/tutorial - Basic Tutorial on DevOps. |
| **5.** | https://mva.microsoft.com/training-topics/devops#!lang=1033 – Lists no. of courses related to DevOps and various tools, methods used. |
| **6.** | http://devops.com/ - A good blog, has lots of contents. |
| **7.** | https://dzone.com/devops-tutorials-tools-news - Lots of l links and tutorials |

# PRAGATI ENGINEERING COLLEGE
## (Autonomous)
## B.Tech
## Computer Science and Engineering (Artificial Intelligence & Machine Learning)

**R-20**

**Operating Systems & Compiler Design using C Laboratory**

**Common to CSE (AI) and CSE (AI&ML)**

**III B. Tech I Semester**

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 20AI5L02 |
| **Course Type** | Laboratory | **L-T-P-C** | 0-0-3-1.5 |
| **Prerequisites** | | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 15<br>35<br>50 |

| **COURSE OBJECTIVES** | |
|---|---|
| **The student will:** | |
| **1** | To provide an understanding of the language translation peculiarities by designing a complete translator for a mini language. |
| **2** | To provide an understanding of the design aspects of operating system |

| **COURSE OUTCOMES** | | |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | **Cognitive Level** |
| **CO1** | Analyze important algorithms eg. Process scheduling and memory management algorithms | K3 |
| **CO2** | Categorize the operating system's resource management techniques, dead lock management techniques, memory management techniques | K4 |
| **CO3** | To implement Lexical Analyzer using Lex tool & Syntax Analyzer or parser using YACC Tool | K3 |

**K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.**

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

| | **PO 1** | **PO 2** | **PO3** | **PO4** | **PO 5** | **PO6** | **PO 7** | **PO 8** | **PO 9** | **PO1 0** | **PO1 1** | **PO12** | **PSO 1** | **PSO 2** | **PSO 3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | 2 | 2 |
| **CO2** | 1 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 1 | 2 | 3 |
| **CO3** | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 |

| List of Experiments | |
|---|---|
| **Part-A (OS)** | |
| 1 | Simulate the following CPU scheduling algorithms<br>a) Round Robin b) Shortest Job First c) Priority |
| 2 | Multiprogramming-Memory management- Implementation of fork (), wait (), exec() and exit(), System calls |
| 3 | Simulate the following<br>a) Multiprogramming with a fixed number of tasks (MFT)<br>b) Multiprogramming with a variable number of tasks (MVT) |
| 4 | Simulate Bankers Algorithm for Dead Lock Avoidance |
| 5 | Simulate Bankers Algorithm for Dead Lock Prevention |
| 6 | Simulate the following page replacement algorithms.<br>a) First In First Out b) Least Recently Used |
| 7 | Simulate the following File allocation strategies<br>a) Sequenced b) Indexed |
| **Part-B (CD)** | |
| 1 | Write a Lex program to implement a Lexical Analyzer using LEX-tool. |
| 2 | Write a C Program to simulate Lexical Analyzer to validate a given input string. |
| 3 | Write a C Program to implement Brute force technique of Top down parsing. |
| 4 | Write a C Program to compute the First and Follow sets for the given Grammar. |
| 5 | Write a C Program to check the validity of input string using predictive parser. |
| 6 | Write a C program to implement LR Parser to accept the given input string. |
| 7 | Simulate the calculator using LEX and YACC tool. |
| 8 | Write a C program to implement Code Generation Algorithm for a given expression. |

# PRAGATI ENGINEERING COLLEGE
## (Autonomous)
## B.Tech
## Computer Science and Engineering (Artificial Intelligence & Machine Learning)

**R-20**

**Machine Learning Laboratory using Python**

**CSE ( AI ML)**

**III B. Tech I Semester**

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 20AM5L02 |
| **Course Type** | Laboratory | **L-T-P-C** | 0-0-3-1.5 |
| **Prerequisites** | Python Programming | **Internal Assessment Semester End Examination Total Marks** | 15<br>35<br>50 |

| **COURSE OBJECTIVES** | |
|---|---|
| **The student will:** | |
| **1** | This course will enable students to learn and understand different Data sets in implementingthe machine learning algorithms. |

| **COURSE OUTCOMES** | | |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | **Cognitive Level** |
| **CO1** | Implement procedures for the machine learning algorithms. | K1 |
| **CO2** | Design and Develop Python programs for various Learning algorithms | K2 |
| **CO3** | Apply appropriate data sets to the Machine Learning algorithms | K3 |
| **CO4** | Develop Machine Learning algorithms to solve real world problems | K4 |

**K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.**

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

| | **PO 1** | **PO 2** | **PO3** | **PO4** | **PO 5** | **PO6** | **PO 7** | **PO 8** | **PO 9** | **PO1 0** | **PO1 1** | **PO12** | **PSO 1** | **PSO 2** | **PSO3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 1 | -- | -- | -- | -- | -- | -- | -- | -- | 2 | 2 | 2 | 3 |
| **CO2** | 3 | 2 | 1 | -- | -- | -- | -- | -- | -- | -- | -- | 1 | 1 | 1 | 3 |
| **CO3** | 3 | 2 | 1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1 | 1 | 3 |

| List of Experiments | |
|---|---|
| 1 | Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on agiven set of training data samples. Read the training data from a .CSV file. |
| 2 | For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent withthe training examples. |
| 3 | Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use anappropriate data set for building the decision tree and apply this knowledge to classify a new sample. |
| 4 | Exercises to solve the real-world problems using the following machine learning methods: a) LinearRegression b) Logistic Regression c) Binary Classifier |
| 5 | Develop a program for Bias, Variance, Remove duplicates , Cross Validation |
| 6 | Write a program to implement Categorical Encoding, One-hot Encoding |
| 7 | Build an Artificial Neural Network by implementing the Back propagation algorithm and test thesame using appropriate data sets. |
| 8 | Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print bothcorrect and wrong predictions. |
| 9 | Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs. |
| 10 | Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set. |
| 11 | Apply EM algorithm to cluster a Heart Disease Data Set. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program. |
| 12 | Exploratory Data Analysis for Classification using Pandas or Matplotlib. |
| 13 | Write a Python program to construct a Bayesian network considering medical data. Use this model todemonstrate the diagnosis of heart patients using standard Heart Disease Data Set. |
| 14 | Write a program to Implement Support Vector Machines and Principle Component Analysis. |
| 15 | Write a program to Implement Principle Component Analysis. |

# PRAGATI ENGINEERING COLLEGE
## (Autonomous)
## B.Tech
## Computer Science and Engineering (Artificial Intelligence & Machine Learning)

**R-20**

## Skill Oriented Course - III
## Continuous Integration and Continuous Delivery using DevOps

| | | | |
|---|---|---|---|
| **Course Category** | Skill Oriented | **Course Code** | 20IT5S05 |
| **Course Type** | Laboratory | **L-T-P-C** | 1-0-2-2 |
| **Prerequisites** | | **Total Marks** | **50** |

**COURSE OBJECTIVES**
The objectives of the course is to

| | |
|---|---|
| **1** | To understand the concept of DevOps with associated technologies and methodologies. |
| **2** | To be familiarized with Jenkins, which is used to build & test software Applications & Continuous integration in Devops environment. |

| **COURSE OUTCOMES** | | **Cognitive level** |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | |
| **CO1** | Remember the importance of DevOps tools used in software development life Cycle | K1 |
| **CO2** | Understand the importance of Jenkins to Build, Deploy and Test Software Applications | K2 |
| **CO3** | Examine the test results of a java program in Jenkins | K2 |

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 1 | 1 | 2 | 1 | 3 | - | - | - | - | - | - | - | 0 | 3 | 2 |
| **CO2** | 1 | 1 | 2 | 1 | 3 | - | - | - | - | - | - | - | 0 | 3 | 2 |
| **CO3** | 1 | 1 | 2 | 1 | 3 | - | - | - | - | - | - | - | 0 | 3 | 2 |

| COURSE CONTENT | |
|---|---|
| **0** | **Prerequisite:** To Understand the Concept of DevOps with related technologies which are used to Code, Build, Test, Configure & Monitor the Software Applications. |
| **1** | Installation of Jenkins |
| **2** | Configuration of Jenkins i.e. creating a first admin user and installing required plugins. |
| **3** | To Create a Freestyle project in Jenkins to test, and deploy Java or Web Applications using Netbeans or eclipse. |
| **4** | To Create a Pipeline project in Jenkins to test, and deploy Java or Web Applications using Netbeans or eclipse. |
| **5** | To do Source code management from GIT in Jenkins while developing a Java application |
| **6** | To do a Controller test in Jenkins while developing a Java application |

| TEXT BOOKS | |
|---|---|
| **1.** | John Ferguson Smart, “Jenkins, The Definitive Guide”, O'Reilly Publication. |
| **2.** | Learn to Master DevOps by StarEdu Solutions. |

| REFERENCE BOOKS | |
|---|---|
| **1.** | Sanjeev Sharma and Bernie Coyne, “DevOps for Dummies”, Wiley Publication |
| **2.** | Httermann, Michael, “DevOps for Developers”, A press Publication. |
| **3.** | Joakim Verona, “Practical DevOps”, Pack publication |

| WEB RESOURCES | |
|---|---|
| **1.** | https://www.udacity.com/course/intro-to-devops--ud611 - Good online course with sample exercises. |
| **2.** | http://www.edureka.co/devops - Online Training covering high level process and tools. (Needs Registration) |
| **3.** | https://www.edx.org/course?search_query=devops – Has no. of courses from MS and Redhat. |
| **4.** | https://www.codementor.io/devops/tutorial - Basic Tutorial on DevOps. |

# PRAGATI ENGINEERING COLLEGE
## (Autonomous)
## B.Tech
## Computer Science and Engineering (Artificial Intelligence & Machine Learning)

**R-20**

## Employability Skills – I

**Common for CSE, CSE AI&ML, CSE DS, CSE AI, and IT**

| | | | |
|---|---|---|---|
| **Course Category** | Humanities | **Course Code** | **20HE5T02** |
| **Course Type** | Theory | **L-T-P-C** | 2 –0 – 0-0 |
| **Prerequisites** | Basic Language Knowledge. | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVE:** | | |
|---|---|---|
| **1** | To present language ability in the interview for employment. | |
| **COURSE OUTCOMES** | | **LEVEL** |
| **Upon successful completion of the course, the student will be able to:** | | |
| **CO1** | Enables the student to be aware of integrated word building to use in communication. | **K -I** |
| **CO2** | Grooms the learner in their mental flexibility to be fit in team for an organization. | **K–II** |
| **CO3** | Strengthens in syntactic construction of the language. | **K -II** |
| **CO4** | Empowers the learner in the language comprehension skills. | **K -II** |
| **CO5** | Assists the learner to present academic and professional abilities through writing skills. | **K-I** |

**(K1 – Remember, K2 – Understand, K-3 Apply, K4 -Analysis, K5 – Evaluate, K6 – Create)**
**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 |
| **CO2** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 |
| **CO3** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| **CO4** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| **CO5** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |

| COURSE CONTENT | |
|---|---|
| **UNIT-I** | **Vocabulary building /Language fluency.**<br>Connotations - Synonyms and Antonyms - Prefix and Suffix - Phrasal Verbs – Collocations. |
| **UNIT-II** | **Attitude/ Team Building**<br>Types of attitudes – Positive attitude – Importance of team work- advantages of team work. |
| **UNIT-III** | **Sentence Completion**<br>Restatement – Comparison – Contrast - Cause and effect. |
| **UNIT-IV** | **Reading comprehension**<br>Literal Comprehension - Interpretative Comprehension - Applied Comprehension - Affective Comprehension. |
| **UNIT-V** | **Resume Writing**<br>Chronological resume - Functional resume. |

| TEXT BOOKS | |
|---|---|
| **1.** | **Soft Skills - Enhancing Employability: Connecting Campus with Corporate** by M. S. RaoI K International Publishing House Pvt. Ltd. |
| **2.** | **Enhancing Employability @ Soft Skills** by Shalini Verma<br>Pearson Education. |
| **3.** | **Soft Skills at Work: Technology for Career Success: 0** by Beverly Amer |
| **4.** | **Resume To HR Interview Prep (Employability Enhancement Series)** by Rajesh Vartak |
| **WEB RESOURCES** | |
| **1.** | https://www.twinkl.co.uk/search?q=employability |
| **2.** | https://www.realityworks.com/product/online-employability-skills-programs/ |
| **3.** | https://connectingcredentials.org/resources/interactive-employability-skills-framework/ |
| **4.** | https://oklahoma.gov/careertech/educators/resource-center/employability-and-adult-basic-education-resources.html |
| **5.** | https://barclayslifeskills.com/educators |

# PRAGATI ENGINEERING COLLEGE
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### B.Tech
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# Computer Networks

**CSE, CSE(AI), CSE(AI&ML), CSE(DS), IT**

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 20CS5T08 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | Understand the basic taxonomy, terminology and architectures of the computer networks |
| **2** | Analyze the services, protocols and features of the various layers of computer networks. |
| **3** | Understand the requirements for a given organizational structure and select the most appropriate networking architecture and technologies. |

| **COURSE OUTCOMES** | | **BTL** |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | |
| **CO1** | Enumerate the basic concepts of Computer Networks | K1 |
| **CO2** | Analyze protocols implemented in Data Link Layer for error and flow control. | K4 |
| **CO3** | Design applications using internet protocols. | K3 |
| **CO4** | Implement routing and congestion control algorithms. | K3 |
| **CO5** | Develop application layer protocols and understand socket programming. | K3 |

**Note:** K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

| | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PS O1** | **PS O2** | **PS O3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 2 | 1 | 2 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 3 | 3 | 0 |
| **CO2** | 3 | 3 | 3 | 3 | 2 | 3 | 0 | 0 | 0 | 0 | 3 | 0 | 3 | 3 | 0 |
| **CO3** | 3 | 2 | 2 | 1 | 1 | 3 | 0 | 0 | 0 | 0 | 1 | 0 | 3 | 2 | 0 |
| **CO4** | 3 | 3 | 3 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3 | 0 |
| **CO5** | 3 | 3 | 3 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3 | 0 |

| COURSE CONTENT | |
|---|---|
| **UNIT I** | **Introduction:** Network Types, LAN, MAN, WAN, Network Topologies Reference models- The OSI Reference Model- the TCP/IP Reference Model - A Comparison of the OSI and TCP/IP Reference Models, OSI Vs TCP/IP, Lack of OSI models success, Internet History.<br>**Physical Layer –**Introduction to Guided Media- Twisted-pair cable, Coaxial cable and Fiber optic cable and unguided media: Wireless-Radio waves, microwaves, infrared. |
| **UNIT II** | **Data link layer:** Design issues, **Framing**: fixed size framing, variable size framing, flow control, error control, error detection and correction codes, CRC, Checksum: idea, one's complement internet checksum, services provided to Network Layer, **Elementary Data Link Layer protocols**: simplex protocol, Simplex stop and wait, Simplex protocol for Noisy Channel.<br>**Sliding window protocol:** One bit, Go back N, Selective repeat-Stop and wait protocol, Data link layer in HDLC: configuration and transfer modes, frames, control field, point to point protocol (PPP): framing transition phase, multiplexing, multi link PPP. |
| **UNIT III** | **Media Access Control: Random Access**: ALOHA, Carrier sense multiple access (CSMA), CSMA with Collision Detection, CSMA with Collision Avoidance, **Controlled Access:** Reservation, Polling, Token Passing, **Channelization:** frequency division multiple Access(FDMA), time division multiple access(TDMA), code division multiple access(CDMA).<br>**Wired LANs:** Ethernet, Ethernet Protocol, Standard Ethernet, Fast Ethernet(100 Mbps), Gigabit Ethernet, 10 Gigabit Ethernet. |
| **UNIT IV** | **The Network Layer Design Issues** – Store and Forward Packet Switching-Services Provided to the Transport layer- Implementation of Connectionless Service-Implementation of Connection Oriented Service- Comparison of Virtual Circuit and Datagram Networks, Routing Algorithms-The Optimality principle-Shortest path, Flooding, Distance vector, Link state, Hierarchical, Congestion Control algorithms-General principles of congestion control, Congestion prevention polices |
| **UNIT V** | **The Transport Layer:** Transport layer protocols: Introduction-services- port number-User data gram protocol-User datagram-UDP services-UDP applications-Transmission control protocol: TCP services- TCP features- Segment- A TCP connection- windows in TCP- flow control-Error control, Congestion control in TCP.<br>**Application Layer** –- World Wide Web: HTTP, Electronic mail-Architecture- web based mail- email security- TELENET-local versus remote Logging-Domain Name System: Name Space, DNS in Internet ,- Resolution-Caching- Resource Records- DNS messages-Registrars-security of DNS Name Servers, SNMP. |

| | |
|---|---|
| **TEXT BOOKS** | |
| **1.** | Computer Networks — Andrew S Tanenbaum, Fifth Edition. Pearson Education/PHI |
| **2.** | Data Communications and Networks – Behrouz A. Forouzan, Fifth Edition TMH. |
| **REFERENCE BOOKS** | |
| **1.** | Data Communications and Networks- Achut S Godbole, AtulKahate ,Second Edition ,McGraw Hill Education |
| **2.** | Computer Networks, Mayank Dave, CENGAGE, First Edition,2017 |
| **WEB RESOURCES** | |
| **1.** | https://nptel.ac.in/courses/106105081 |
| **2.** | https://nptel.ac.in/courses/106105183 |

# PRAGATI ENGINEERING COLLEGE
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## B.Tech
## Computer Science and Engineering (Artificial Intelligence & Machine Learning)

**R-20**

## Deep Learning
**CSE ( AI ML)**

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 20AM6T04 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | Machine Learning | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **The student will:** | |
| **1** | Learn deep learning methods for working with sequential data. |
| **2** | Learn deep recurrent and memory networks. |
| **3** | Learn deep Turing machines. |
| **4** | Apply such deep learning mechanisms to various learning problems. |
| **5** | Know the open issues in deep learning, and have a grasp of the current research directions. |

| **COURSE OUTCOMES** | | |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | **Cognitive Level** |
| **CO1** | Demonstrate the fundamental concepts learning techniques of Artificial Intelligence, Machine Learning and Deep Learning. | K1 |
| **CO2** | Discuss the Neural Network training, various random models**.** | K2 |
| **CO3** | Explain the Techniques of Keras, TensorFlow, Theano and CNTK. | K3 |
| **CO4** | Classify the Concepts of CNN and RNN. | K4 |
| **CO5** | Implement Interactive Applications of Deep Learning. | K4 |

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

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

| COURSE CONTENT | |
|---|---|
| **UNIT-I** | **Fundamentals of Deep Learning**: Artificial Intelligence, History of Machine learning: Probabilistic Modeling, Early Neural Networks, Kernel Methods, Decision Trees, Random forests and Gradient Boosting Machines,<br>**Fundamentals of Machine Learning**: Four Branches of Machine Learning, Evaluating Machine learning Models, Overfitting and Underfitting. [**Text Book 2**] |
| **UNIT-II** | **Introducing Deep Learning**: Biological and Machine Vision, Human and Machine Language, Artificial Neural Networks, Training Deep Networks, Improving Deep Networks. [**Ref Book 1**] |
| **UNIT-III** | Neural Networks: Anatomy of Neural Network, Introduction to Keras: Keras, TensorFlow, Theano and CNTK, Setting up Deep Learning Workstation, Classifying Movie Reviews, Binary Classification, Classifying newswires, Multiclass Classification. [**Text Book 2**] |
| **UNIT-IV** | **Convolutional Neural Networks**: Nerual Network and Representation Learing, Convolutional Layers, Multichannel Convolution Operation.<br>**Recurrent Neural Networks**: Introduction to RNN, RNN Code, PyTorch Tensors: Deep Learning with PyTorch, CNN in PyTorch. [**Ref Book 1**] |
| **UNIT-V** | **Interactive Applications of Deep Learning**: Machine Vision, Natural Language processing, Generative Adversial Networks, Deep Reinforcement Learning. [**Text Book 1**]<br>**Deep Learning Research**: Autoencoders, Deep Generative Models: Boltzmann Machines Restricted Boltzmann Machines, Deep Belief Networks. [**Text Book 1**] |

| TEXT BOOKS | |
|---|---|
| **1.** | Deep Learning- Ian Goodfellow, Yoshua Bengio and Aaron Courvile, MIT Press, 2016 |
| **2.** | Deep Learning with Python - Francois Chollet, Released December 2017, Publisher(s):Manning Publications, ISBN: 9781617294433. |
| **REFERENCE BOOKS** | |
| **1.** | Deep Learning Illustrated: A Visual, Interactive Guide to Artificial Intelligence - Jon Krohn, Grant Beyleveld, Aglaé Bassens, Released September 2019, Publisher(s): Addison-Wesley Professional, ISBN: 9780135116821 |
| **2.** | Deep Learning from Scratch - Seth Weidman, Released September 2019, Publisher(s): O'Reilly Media, Inc., ISBN: 9781492041412 |
| **3.** | Artificial Neural Networks, Yegnanarayana, B., PHI Learning Pvt. Ltd, 2009. |
| **4.** | Matrix Computations, Golub, G.,H., and Van Loan,C.,F, JHU Press,2013. |
| **5.** | Neural Networks: A Classroom Approach, Satish Kumar, Tata McGraw-Hill Education,2004. |
| **WEB RESOURCES:** | |
| **1** | Swayam NPTEL: Deep Learning: https://onlinecourses.nptel.ac.in/noc22_cs22/preview |

# Design and Analysis of Algorithms

**CSE, CSE(AI), CSE(AI&ML), CSE(DS), IT**

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 20CS5T09 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | Able to interpret algorithms and their time complexity |
| **2** | Able to interpret Greedy and Divide and Conquer methods using algorithms |
| **3** | Able to solve backtracking and dynamic programming problems |
| **4** | Able to identify NP-Hard & NP-Complete classes |

| **COURSE OUTCOMES** | | **BTL** |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | |
| **CO1** | Analyze the performance of a given algorithm, denote its time complexity using the asymptotic notation for recursive and non-recursive algorithms | K4 |
| **CO2** | List and describe various algorithmic approaches and Solve problems using divide and conquer &greedy Method | K3 |
| **CO3** | Synthesize efficient algorithms dynamic programming approaches to solve in common engineering design situations. | K3 |
| **CO4** | Analyze design paradigms and methods of analysis: backtracking, branch and bound algorithmic approaches | K4 |
| **CO5** | Demonstrate NP-Hard and NP-Complete classes, Cook's theorem | K2 |

**Note:** K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

| | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PS O1** | **PS O2** | **PS O3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| **CO2** | 3 | 2 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | - |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO3** | 3 | 2 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | - |
| **CO4** | 3 | 3 | 2 | 3 | - | - | - | - | - | - | - | - | - | 3 | - |
| **CO5** | 3 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 3 | - |

| **COURSE CONTENT** | |
|---|---|
| **UNIT I** | **Introduction:** Algorithm Definition, Algorithm Specification, performance Analysis, Performance measurement, asymptotic notation, Randomized Algorithms. |
| **UNIT II** | **Divide and Conquer:** General Method, Defective chessboard, Binary Search, finding the maximum and minimum, Merge sort, Quick sort.<br>**The Greedy Method:** The general Method, knapsack problem, minimum-cost spanning Trees, Optimal Merge Patterns, Single Source Shortest Paths. |
| **UNIT III** | **Dynamic Programming:** The general method, multistage graphs, All pairs-shortest paths, optimal Binary search trees, 0/1 knapsack, The traveling salesperson problem. |
| **UNIT IV** | **Backtracking:** The General Method, The 8-Queens problem, sum of subsets, Graph coloring, Hamiltonian cycles, knapsack problem. |
| **UNIT V** | **P and NP problems:** Basic concepts, Class P, Fractional Knapsack problem in P, Class NP, Fractional Knapsack problem in NP<br>**NP-Hard and NP-Complete problems:** Basic concepts, non-deterministic algorithms, NP - Hard and NP-Complete classes, Cook‘s theorem. |

| **TEXT BOOKS** | |
|---|---|
| **1.** | Ellis Horowitz, SartajSahni, Sanguthevar Rajasekaran, ‐Fundamentals of Computer Algorithms|, 2nd Edition, Universities Press,2010. |
| **2.** | Introduction to Algorithms Thomas H. Cormen, PHI Learning,Fourth Edition 2020. |
| **REFERENCE BOOKS** | |
| **1.** | Harsh Bhasin, ―Algorithms Design & Analysis|, Oxford University Press 2015. |
| **2.** | Horowitz E. Sahani S: ‐Fundamentals of Computer Algorithms|, 2nd Edition, Galgotia Publications,2010 |
| **3.** | S. Sridhar, ‐Design and Analysis of Algorithms|, Oxford University Press,2014. |
| **WEB RESOURCES** | |
| **1.** | https://nptel.ac.in/courses/106/105/106105164/ |

# PRAGATI ENGINEERING COLLEGE
## (Autonomous)
### B.Tech
### Computer Science and Engineering (Artificial Intelligence & Machine Learning)

**R-20**

## Professional Elective – II

## Software Project Management

**CSE, CSE(AI), CSE(AI&ML), CSE(DS)**

| | | | |
|---|---|---|---|
| **Course Category** | Professional Elective | **Course Code** | 20CS5T12 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To describe and determine the purpose and importance of project management from the perspectives of planning, tracking and completion of project |
| **2** | To compare and differentiate organization structures and project structures |
| **3** | To implement a project to manage project schedule, expenses and resources with the application of suitable project management tools |

| **COURSE OUTCOMES** | | **BTL** |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | |
| **CO1** | Apply the process to be followed in the software development life-cycle models | K3 |
| **CO2** | Apply the concepts of project management & planning | K3 |
| **CO3** | Develop the project plans through managing people, communications and change | K3 |
| **CO4** | Conduct activities necessary to successfully complete and close the Software projects | K2 |
| **CO5** | Implement communication, modeling, and construction & deployment practices in software development | K3 |

**Note:** K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

| | **PO1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PS O1** | **PS O2** | **PS O3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 1 | 1 | 1 | 1 | 3 | - | - | 1 | 2 | 2 | 3 | 2 | 2 | 2 | 3 |
| **CO2** | 1 | 2 | 2 | 2 | 1 | - | - | 1 | 2 | 2 | 3 | 2 | 2 | 2 | 2 |
| **CO3** | 1 | 1 | 2 | 1 | 2 | - | - | 1 | 2 | 2 | 3 | 2 | 1 | 2 | 3 |
| **CO4** | 1 | 2 | 2 | 2 | 1 | - | - | 1 | 2 | 2 | 3 | 2 | 3 | 1 | 2 |

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

| **COURSE CONTENT** | |
|---|---|
| **UNIT I** | **Conventional Software Management:** The waterfall model, conventional software Management performance.<br>**Evolution of Software Economics:** Software Economics, pragmatic software cost estimation.<br>**Improving Software Economics:** Reducing Software product size, improving software processes, improving team effectiveness, improving automation, Achieving required quality, peer inspections.<br>**The old way and the new:** The principles of conventional software Engineering, principles of modern software management, transitioning to an iterative process. |
| **UNIT II** | **Life cycle phases:** Engineering and production stages, inception, Elaboration, construction, transition phases.<br>**Artifacts of the process:** The artifact sets, Management artifacts, Engineering artifacts, programmatic artifacts. |
| **UNIT III** | **Model based software architectures:** A Management perspective and technical perspective.<br>**Work Flows of the process:** Software process workflows, Iteration workflows.<br>**Checkpoints of the process: Major** mile stones, Minor Milestones, Periodic status assessments.<br>**Iterative Process Planning:** Work breakdown structures, planning guidelines, cost and schedule estimating, Iteration planning process, Pragmatic planning. |
| **UNIT IV** | **Project Organizations and Responsibilities:** Line-of-Business Organizations, Project Organizations, evolution of Organizations.<br>**Process Automation:** Automation Building blocks, The Project Environment.<br>**Project Control and Process instrumentation:** The seven core Metrics, Management indicators, quality indicators, life cycle expectations, pragmatic Software Metrics, Metrics automation. |
| **UNIT V** | Agile Methodology, ADAPTing to Scrum, Patterns for Adopting Scrum, Iterating towards Agility.<br>**Fundamentals of DevOps**: Architecture, Deployments, Orchestration, Need, Instance of applications, DevOps delivery pipeline, DevOps eco system. DevOps adoption in projects: Technology aspects, Agiling capabilities, Tool stack implementation, People aspect, processes |

| | |
|---|---|
| **TEXT BOOKS** | |
| **1.** | Software Project Management, Walker Royce, PEA, 2005. |
| **2.** | Succeeding with Agile: Software Development Using Scrum, Mike Cohn, Addison Wesley.7/e 2013. |
| **REFERENCE BOOKS** | |
| **1.** | The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations, Gene Kim , John Willis , Patrick Debois , Jez Humb,1st Edition, O'Reilly publications, 2016. |
| **2.** | Software Project Management, Bob Hughes,6/e, Mike Cotterell, TMH,2017 |
| **3.** | Software Project Management, Joel Henry, PEA,2003 |
| **4.** | Software Project Management in practice, Pankaj Jalote, PEA, 2005 |
| **5.** | Effective Software Project Management, Robert K.Wysocki, Wiley,2006 |
| **6.** | Project Management in IT, Kathy Schwalbe, Cengage,Third Edition 2004 |
| **WEB RESOURCES** | |
| **1.** | https://nptel.ac.in/courses/106/105/106105218/ |

# Distributed Systems

**CSE, CSE(AI), CSE(AI&ML), CSE(DS), IT**

| | | | |
|---|---|---|---|
| **Course Category** | Professional Elective | **Course Code** | 20CS5T13 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To understand the foundations of distributed systems |
| **2** | To learn issues related to clock Synchronization and the need for global state in distributed systems |
| **3** | To learn distributed mutual exclusion and deadlock detection algorithms |
| **4** | To understand the significance of agreement, fault tolerance and recovery protocols in Distributed Systems |
| **5** | To learn the characteristics of peer-to-peer and distributed shared memory systems |

| **COURSE OUTCOMES** | | **BTL** |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | |
| **CO1** | Understand the foundations and issues of distributed systems | K2 |
| **CO2** | Illustrate the various synchronization issues and global state for distributed systems | K2 |
| **CO3** | Illustrate the Mutual Exclusion and Deadlock detection algorithms in distributed systems | K2 |
| **CO4** | Describe the agreement protocols and fault tolerance mechanisms in distributed systems | K2 |
| **CO5** | Describe the features of peer-to-peer and distributed shared memory systems | K2 |

**Note:** K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

| Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
| CO1 | 3 | 1 | 2 | 2 | - | - | - | - | - | - | - | - | 3 | 2 | - |
| CO2 | 2 | 3 | 1 | 2 | - | - | - | - | - | - | - | - | 3 | 2 | - |
| CO3 | 2 | 3 | 1 | 2 | - | - | - | - | - | - | - | - | 3 | 2 | - |
| CO4 | 3 | 1 | 3 | 2 | - | - | - | - | - | - | - | - | 3 | 2 | - |
| CO5 | 2 | 1 | 2 | 2 | - | - | - | - | - | - | - | - | 3 | 2 | - |

| COURSE CONTENT | |
|---|---|
| UNIT I | **Distributed Systems**: Definition, Relation to computer system components, Motivation, Relation to parallel systems, Message-passing systems versus shared memory systems, Primitives for distributed communication, Synchronous versus asynchronous executions, Design issues andchallenges.<br>A model of distributed computations: A distributed program, A model of distributed executions, Models of communication networks, Global state, Cuts, Past and future cones of an event, Modelsof process communications.<br>Logical Time: A framework for a system of logical clocks, Scalar time, Vector time, Physical clock synchronization: NTP. |
| UNIT II | Message Ordering & Snapshots: Message ordering and group communication: Message ordering paradigms, Asynchronous execution with synchronous communication, Synchronous program order on an asynchronous system, Group communication, Causal order (CO), Total order. Global state and snapshot recording algorithms: Introduction, System model and definitions, Snapshot algorithms for FIFO channels. |
| UNIT III | Distributed Mutex & Deadlock: Distributed mutual exclusion algorithms: Introduction, Preliminaries, Lamport_s algorithm, Ricart-Agrawala algorithm, Maekawa_s algorithm, Suzuki–Kasami_s broadcast algorithm. Deadlock detection in distributed systems: Introduction, System model, Preliminaries, Models of deadlocks, Knapp_s classification, Algorithms forthe single resource model, the AND model and the OR model. |
| UNIT IV | Recovery & Consensus: Check pointing and rollback recovery: Introduction, Background and definitions, Issues in failure recovery, Checkpoint-based recovery, Log-based rollback recovery, Coordinated check pointing algorithm, Algorithm for asynchronous check pointing and recovery. Consensus and agreement algorithms: Problem definition, Overview of results, Agreement in a failure, free system, Agreement in synchronous systems with failures. |
| UNIT V | Peer-to-peer computing and overlay graphs: Introduction, Data indexing and overlays, Chord –Content addressable networks, Tapestry.<br>Distributed shared memory: Abstraction and advantages, Memory consistency models, Shared memory Mutual Exclusion. |

| | |
|---|---|
| **TEXT BOOKS** | |
| **1.** | Distributed Systems Concepts and Design, George Coulouris, Jean Dollimore and Tim Kindberg, Fifth Edition, Pearson Education, 2012. |
| **2.** | Distributed Computing: Principles, algorithms, and systems, Ajay Kshemkalyani and Mukesh Singhal, Cambridge University Press,First Edition 2011. |
| **REFERENCE BOOKS** | |
| **1.** | Distributed Operating Systems: Concepts and Design, Pradeep K Sinha, Prentice Hall ofIndia, 2007. |
| **2.** | Advanced concepts in operating systems. Mukesh Singhal and Niranjan G. Shivaratri,McGraw-Hill, 2017. |
| **3.** | Distributed Systems: Principles and Paradigms, Tanenbaum A.S., Van Steen M.,Pearson Education, 2007. |
| **WEB RESOURCES** | |
| **1.** | https://nptel.ac.in/courses/106/106/106106168/ |

# Game Theory

**Common CSE ( AI ML), CSE(AI) & CSE (DS)**

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 20AM6T05 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | Probability and Statistics | **Internal Assessment**<br>**Semester End Examination Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **The student will:** | |
| **1** | Learn the various methods of Game Theory and how to get the solutions. |
| **2** | Learn about Mixed and Correlated Equilibrium Interpretations. |
| **3** | Learn about the various models of Knowledge and Equilibrium. |
| **4** | Apply Extensive games with perfect information. |
| **5** | Know about the Repeated games and its strategies. |

| **COURSE OUTCOMES** | | |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | **Cognitive Level** |
| **CO1** | Discuss the various methods of Game Theory concepts and how to get the solutions. | K1 |
| **CO2** | Discuss about Mixed and Correlated Equilibrium Interpretations**.** | K2 |
| **CO3** | Explain about the various models of Knowledge and Equilibrium. | K3 |
| **CO4** | Learn about Extensive Games with Perfect Information. | K3 |
| **CO5** | Implement about Repeated Games and its various strategies. | K3 |

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

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

| COURSE CONTENT | |
|---|---|
| **UNIT-I** | **Introduction**: Game Theory, Games and Solutions, Game Theory and the Theory of Competitive Equilibrium, Rational Behavior, The Steady State and Deductive Interpretations, Bounded Rationality Terminology and Notation Nash Equilibrium- Strategic Games, Nash Equilibrium Examples Existence of a Nash Equilibrium, Strictly Competitive Games. |
| **UNIT-II** | **Mixed, Correlated, and Evolutionary Equilibrium** - Mixed Strategy, Nash Equilibrium Interpretations of Mixed Strategy, Nash Equilibrium, Correlated Equilibrium, Evolutionary Equilibrium, Rationalizability and Iterated Elimination of Dominated Actions. - Rationalizability Iterated Elimination of Strictly Dominated Actions, Iterated Elimination of Weakly Dominated Actions. |
| **UNIT-III** | **Combinatorial games**: Winning and losing positions, Subtraction Game, 3-Pile and K-Pile Games, Proof of Correctness, Variations of K-Pile Games, Graph Games, Construction, Proof of finiteness, SG theorem for sum of games. |
| **UNIT-IV** | Extensive Games with Perfect Information – Extensive Games with Perfect Information Subgame Perfect Equilibrium Two Extensions of the Definition of a Game The Interpretation of a Strategy, Two Notable Finite Horizon Games, Iterated Elimination of Weakly Dominated Strategies. |
| **UNIT-V** | Cournot's Oligopoly, Bertrand's Oligopoly, Electoral Competition, Median Voter Theorem, Auctions, role of knowledge, Decision making and Utility Theory, Mixed Strategy Equilibrium, Extensive Games with Perfect Information, Stackelberg's model of Duopoly, Buying Votes, Committee Decision making, Repeated Gmes, Prisoner's Dilemma, Supermodular Game and Potential games. |

| TEXT BOOKS | |
|---|---|
| **1.** | M. J. Osborne and A. Rubinstein, A Course in Game Theory, MIT Press, 1994. |
| **2.** | Martin Osborne, An Introduction to Game Theory, Oxford University Press. 1994 |
| **REFERENCE BOOKS** | |
| **1.** | D. Fudenberg and J. Tirole, Game Theory, MIT Press. 1991. |
| **2.** | J. von Neumann and O. Morgenstern, Theory of Games and Economic Behavior, New York:n John Wiley and Sons. |
| **3.** | R.D. Luce and H. Raiffa, Games and Decisions, New York: John Wiley and Sons. |
| **4.** | G. Owen, Game Theory, (Second Edition), New York: Academic Press. |
| **WEB RESOURCES:** | |
| **1** | Swayam NPTEL: Game Theory: https://onlinecourses.nptel.ac.in/noc19_ge32/preview |

# PRAGATI ENGINEERING COLLEGE
## (Autonomous)
## B.Tech
## Computer Science and Engineering (Artificial Intelligence & Machine Learning)

**R-20**

# Network Programming

| | | | |
|---|---|---|---|
| **Course Category** | Professional Elective | **Course Code** | 20CS6T17 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | Demonstrate mastery of main protocols comprising the Internet. |
| **2** | Develop skills in network programming techniques. |
| **3** | Implement network services that communicate through the Internet |
| **4** | Apply the client-server model in networking applications. |
| **5** | Practice networking commands available through the operating system |

| **COURSE OUTCOMES** | | **BTL** |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | |
| **CO1** | Compare and Contrast different models and sockets | K2 |
| **CO2** | Demonstrate different TCP Echo server functions and I/O models | K2 |
| **CO3** | Outline IPV4 and IPV6 Socket options | K2 |
| **CO4** | Summarize daemon processing and Advanced input and output functions | K2 |
| **CO5** | Analyze Broadcasting and multicasting | K4 |

**Note:** K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

| Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
| CO1 | 3 | 3 | 3 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 2 | 2 |
| CO2 | 3 | 3 | 3 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 2 | 2 |
| CO3 | 3 | 3 | 3 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 2 | 2 |
| CO4 | 3 | 3 | 3 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 2 | 2 |
| CO5 | 3 | 3 | 3 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 2 | 2 |

| COURSE CONTENT | |
|---|---|
| UNIT I | **Introduction to Network Programming:** Introduction to Network Programming: OSI model, UNIX standards, TCP and UDP & TCP connection establishment and Format, Buffer sizes and limitation, standard internet services, Protocol usage by common internet application Elementary Sockets: Sockets introduction, Elementary TCP sockets. |
| UNIT II | **TCP client server:** Introduction, TCP Echo server functions, Normal startup, terminate and signal handling server process termination, Crashing and Rebooting of server host shutdown of server host.I/O Multiplexing: I/O Models, the select and poll functions, Batch input and buffering, shutdown function. |
| UNIT III | **UDP and Socket options: Elementary UDP sockets:** Introduction UDP Echo server functions, lost datagram, summary of UDP example, Lack of flow control with UDP. **Socket options:** getsockopt and setsockopt functions. Socket states, Generic socket options IPV4 socket options, IPV6 socket options, ICMPV6 socket options and TCP socket options, SCTP socket options, fcntl function. |
| UNIT IV | **Advanced Sockets and Daemon Processes:** IPV4 and IPV6 interoperability, introduction, IPV4 client: IPV6 server, IPV6 client: IPV4 Server, IPV6 Address-testing macros. Daemon Processes and inetdSuperserver –Introduction, syslogd Daemon, syslog Function, daemon_init Function, inetd Daemon, daemon_inetd. Advanced I/O functions: Socket timeouts, recv and send functions, ready and writev functions, recvmsg and send msg functions, Ancillary data. |
| UNIT V | **Broadcasting and Multicasting:** Broadcasting introduction, broadcast addresses, unicast versus Broadcast, dg_cli function using broadcasting, race conditions, Multicasting addresses, multicasting versus broadcasting on a LAN, multicasting on a WAN, source-specific multicast, multcast socket options. **Raw Sockets**: Introduction, Raw Socket Creation, Raw Socket Output, Raw Socket Input, Ping Program, Traceroute Program |

| | |
|---|---|
| **TEXT BOOKS** | |
| **1.** | UNIX Network Programming, by W. Richard Stevens, Bill Fenner, Andrew M. Rudoff, Pearson Education,Third Edition,2003 |
| **2.** | UNIX Network Programming, 1st Edition, W. Richard Stevens. PHI. |
| **REFERENCE BOOKS** | |
| **1.** | UNIX Systems Programming using C++ T CHAN, PHI. |
| **2.** | UNIX for Programmers and Users, 3rd Edition Graham GLASS, King abls, Pearson Education |
| **3.** | Advanced UNIX Programming 2nd Edition M. J. ROCHKIND, Pearson Education |
| **WEB RESOURCES** | |
| **1.** | http://www.nitttrc.edu.in/nptel/courses/video/106105183/L24.html |

# Open Elective - II

## Disaster Management

| | | | |
|---|---|---|---|
| **Course Category** | Open Elective | **Course Code** | 20CE6T40 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | ---------- | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| 1 | To provide basic conceptual understanding of disasters. |
| 2 | To understand approaches of Disaster Management. |
| 3 | To build skills to respond to disaster. |
| 4 | To understand to reduce the intensity of future disasters. |
| 5 | To understand the Restoration of human life in the region. |

| **COURSE OUTCOMES** | | |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | |
| **CO1** | Knowledge on characteristics of natural disasters | K2 |
| **CO2** | Planning on approaches of Disaster Management | K2 |
| **CO3** | Ability to plan and design the new skills in disaster response | K2 |
| **CO4** | Role of remote sensing system in disaster area response | K2 |
| **CO5** | Knowledge on the Restoration of human life in the region. | K2 |

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

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

| COURSE CONTENT | |
|---|---|
| **UNIT I** | **Natural Hazards and Disaster Management**: Introduction of DM – Inter disciplinary nature of the subject– Disaster Management cycle – Five priorities for action. Case study methods of the following: Vegetal Cover floods, droughts – Earthquakes – landslides – global warming, cyclones & Tsunamis – Post Tsunami hazards along the Indian coast. |
| **UNIT II** | **Man Made Disaster and Their Management Along With Case Study Methods Of The Following:** Fire hazards – transport hazard dynamics – solid waste management – post disaster – bio terrorism -threat in mega cities, rail and aircraft accidents, ground water, industries - Emerging infectious diseases and Aids and their management. |
| **UNIT III** | **Risk and Vulnerability:** Building codes and land use planning – Social Vulnerability – Environmental vulnerability – Macro-economic management and sustainable development, Climate change risk rendition – Financial management of disaster – related losses |
| **UNIT IV** | **Role of Technology in Disaster Managements:** Disaster management for infra structures, taxonomy of infra structure – treatment plants and process facilities- electrical substations- roads and bridges mitigation programme for earth quakes – flowchart, geospatial information in agriculture drought assessment - Multimedia Technology in disaster risk management and training - Transformable Indigenous Knowledge in disaster reduction – Role of RS & GIS |
| **UNIT V** | **Multi-sectional Issues, Education and Community Preparedness:** Impact of disaster on poverty and deprivation - Climate change adaptation and human health - Exposure, health hazards and environmental risk-Forest management and disaster risk reduction -The Red cross and red crescent movement - Corporate sector and disaster risk reduction- Education in disaster risk reduction Essentials of school disaster education - Community capacity and disaster resilience-Community based disaster recovery - Community based disaster management and social capital-Designing resilience- building community capacity for action |

| TEXT BOOKS | |
|---|---|
| 1. | –Disaster Management guide lines|, GOI-UND Disaster Risk program (2009-2012) |
| 2. | Modh S. (2010) –Managing Natural Disasters|, Mac Millan publishers India LTD. |
| **REFERENCE BOOKS** | |
| 1. | Murty D.B.N. (2012) –Disaster Management|, Deep and Deep Publication PVT.Ltd. New Delhi |
| **WEB RESOURCES** | |
| 1 | https://onlinecourses.swayam2.ac.in/cec19_hs20/preview |

# Fundamentals of Electric Vehicles

| | | | |
|---|---|---|---|
| **Course Category** | Open Elective | **Course Code** | 20EE6T19 |
| **Course Type** | Theory | **L-T-P-C** | **3-0-0-3** |
| **Prerequisites** | **NIL** | **Internal Assessment** | **30** |
| | | **Semester End Examination** | **70** |
| | | **Total Marks** | **100** |

| **COURSE OBJECTIVES** | |
|---|---|
| 1 | To familiarize the students with the need and advantages of electric and hybrid electric vehicles. |
| 2 | To understand various power converters used in electric vehicles. |
| 3 | To know various architecture of hybrid electric vehicles. |
| 4 | To be familiar all the different types of motors suitable for electric vehicles. |
| 5 | To have knowledge on latest developments in strategies and other storage systems. |

| **COURSE OUTCOMES** | | |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | **Cognitive Level** |
| CO1 | Illustrate different types of electric vehicles.. | K3 |
| CO2 | Select suitable power converters for EV applications. | K2 |
| CO3 | Design HEV configuration for a specific application. | K4 |
| CO4 | Choose an effective method for EV and HEV applications. | K3 |
| CO5 | Analyze a battery management system for EV and HEV | K4 |
| K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create | | |

| **Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)** | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO 1** | **PO2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO1** | **PSO 2** |
| **CO1** | 1 | - | - | - | - | 2 | 2 | - | - | - | - | 2 | 1 | 1 |
| **CO2** | 2 | 3 | - | - | - | 1 | 1 | - | - | - | - | - | 2 | 2 |
| **CO3** | - | 3 | - | - | - | 1 | - | - | - | - | 2 | 2 | 1 | 2 |
| **CO4** | 3 | 2 | - | - | - | 2 | 1 | - | - | - | 2 | - | 1 | 2 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO5** | 2 | - | - | - | - | 2 | - | - | - | - | - | 2 | 2 | 2 |

| **COURSE CONTENT** | |
|---|---|
| **UNIT 1** | **Introduction**<br>Fundamentals of vehicles - Components of conventional vehicles - drawbacks of conventional vehicles – Need for electric vehicles - History of Electric Vehicles – Types of Electric Vehicles – Advantages and applications of Electric Vehicles. |
| **UNIT 2** | **Components of Electric Vehicles**<br>Main components of Electric Vehicles – Power Converters - Controller and Electric Traction Motor – Rectifiers used in EVs – Bidirectional DC–DC Converters – Voltage Source Inverters – PWM inverters used in EVs. |
| **UNIT 3** | **Hybrid Electric Vehicles**<br>Evolution of Hybrid Electric Vehicles – Advantages and Applications of Hybrid Electric Vehicles – Architecture of HEVs - Series and Parallel HEVs – Complex HEVs – Range extended HEVs – Examples - Merits and Demerits. |
| **UNIT 4** | **Motors for Electric Vehicles**<br>Characteristics of traction drive - requirements of electric machines for EVs – Different motors suitable for Electric and Hybrid Vehicles – Induction Motors – Synchronous Motors – Permanent Magnetic Synchronous Motors – Brushless DC Motors – Switched Reluctance Motors (Construction details and working only) |
| **UNIT 5** | **Energy Sources for Electric Vehicles**<br>Batteries - Types of Batteries – Lithium-ion - Nickel-metal hydride - Lead-acid – Comparison of Batteries - Battery Management System – Ultra capacitors – Flywheels – Fuel Cell – it‘s working. |

| **TEXT BOOKS** | |
|---|---|
| 1 | Iqbal Hussein - Electric and Hybrid Vehicles: Design Fundamentals - CRC Press - 2021. |
| 2 | Denton - Tom. Electric and hybrid vehicles. Rutledge - 2020. |
| **REFERENCE BOOKS** | |
| 1 | Kumar - L. Ashok - and S. Albert Alexander. Power Converters for Electric Vehicles. CRC Press - 2020. |
| 2 | Chau - Kwok Tong. Electric vehicle machines and drives: design - Analysis andApplication. John Wiley & Sons - 2015. |
| 3 | Berg - Helena. Batteries for electric vehicles: materials and electrochemistry. Cambridge university press - 2015 |
| **WEB RESOURCES (Suggested)** | |
| 1 | https://nptel.ac.in/courses/108106170 |
| 2 | https://inverted.in/blog/fundamentals-of-electric-vehicles |

# Introduction to Automobile Engineering

| | | | |
|---|---|---|---|
| **Course Category** | Open Elective | **Course Code** | 20ME6T25 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | NIL | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To learn functions of different components in Automobiles |
| **2** | To impart knowledge on Transmission systems and Steering Systems. |
| **3** | To impart the knowledge on ignition system & suspension systems. |
| **4** | To impart the knowledge of Braking system and Engine specification. |
| **5** | To understand the concept of safety and Engine emission control systems |

| **COURSE OUTCOMES** | | |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | **Cognitive Level** |
| **CO1** | Understand the function of various components of automobile. | K2 |
| **CO2** | Identify the merits and demerits of the various transmission and steering systems. | K2 |
| **CO3** | Describe the concept of Ignition and Suspension systems. | K2 |
| **CO4** | Explain the features of Braking system and Engine specification. | K3 |
| **CO5** | Analyze the Engine emission control standards. | K3 |

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

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

| COURSE CONTENT | |
|---|---|
| **UNIT 1** | INTRODUCTION: Components of four-wheeler automobile-chassis and body-power unit-types of automobile engines, engine construction, oil filters, oil pumps, air filters, Fuel pump, nozzle, Types of carburetors. |
| **UNIT 2** | TRANSMISSION SYSTEM: Clutches, principle, types, cone clutch, single plate clutch, multi plate clutch, magnetic and centrifugal clutches, Propeller shaft-Hotch-Kiss drive, Torque tube drive, universal joint, differential rear axles-types-wheels and tires.<br>STEERING SYSTEM: Steering geometry-camber, castor, king pin rake, combined angle toe-in, center point steering. steering gears – types, steering linkages. |
| **UNIT 3** | IGNITION SYSTEM: Function of an ignition system, auto transformer, electronic ignition using contact triggers-spark advance and retard mechanism.<br>SUSPENSION SYSTEM: Objects of suspension systems-rigid axle suspension system, torsion bar, shock absorber, independent suspension system. |
| **UNIT 4** | BRAKING SYSTEM: Mechanical brake system, hydraulic brake system, master cylinder, pneumatic and vacuum brakes.<br>ENGINE SPECIFICATION: Introduction-engine specifications with regard to power, speed, torque, no. of cylinders and arrangement. |
| **UNIT 5** | SAFETY SYSTEMS: Introduction, safety systems - seat belt, air bags, bumper, wind shield, suspension sensors, traction control, mirrors.<br>ENGINE EMISSION CONTROL: Introduction-types of pollutants, mechanism of formation, concentration measurement, methods of controlling-engine modification. |

| **TEXT BOOKS** | |
|---|---|
| 1 | Automotive Mechanics / Heitner. |
| 2 | Automobile Engineering / William Crouse, TMH Distributors |
| 3 | Automobile Engineering- P.S Gill, S.K. Kataria& Sons, New Delhi |
| **REFERENCE BOOKS** | |
| 1 | Automotive Engines Theory and Servicing, James D. Halderman and Chase D. Mitchell Jr., Pearson education inc. |
| 2 | Automotive Engineering / Newton Steeds & Garrett. |
| 3 | Automotive Mechanics – Vol. 1 & Vol. 2 / Kripal Singh, standard publishers. |
| **WEB RESOURCES (Suggested)** | |
| 1 | https://nptel.ac.in/courses/107/106/107106080/ |
| 2 | http://gabook.cyou/file/nptel-automobile-engineering |
| 3 | https://nptel.ac.in/courses/107/106/107106088/ |

# Sensors and Transducers

| | | | |
|---|---|---|---|
| **Course Category** | Open Elective | **Course Code** | 20EC6T26 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 25<br>75<br>100 |

| COURSE OBJECTIVES: By studying this course the student will learn | |
|---|---|
| 1 | the principle of various Transducers and their construction |
| 2 | the transducer construction, classification, principle of operation and characteristics |
| 3 | about transducers for measurement of physical parameters |
| 4 | Temperature measurement using transducers |
| 5 | Applications and principles of operation, standards and units of measurements |

| **COURSE OUTCOMES** | | |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | **Cognitive Level** |
| **CO1** | discuss role of transducers and Sensor in instrumentation | K1 |
| **CO2** | Descriptive view for the transducer construction, classification, principle of operation and characteristics. | K2 |
| **CO3** | Gain knowledge about transducers for measurement of displacement, strain, velocity, analyze transducers for measurement of pressure , force and flow | K3 |
| **CO4** | analyze transducers for measurement of Temperature | K4 |
| **CO5** | Analyze sensors used in industrial applications | K4 |

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

| **Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)** | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
| **CO1** | 1 | 2 | 2 | - | 1 | - | - | - | - | - | - | - | - | - | - |
| **CO2** | 1 | 2 | 2 | - | 1 | - | - | - | - | - | - | - | - | - | - |
| **CO3** | 2 | 2 | 2 | - | 2 | - | - | - | - | - | - | - | - | - | - |
| **CO4** | 2 | 3 | 2 | - | 2 | - | - | - | - | - | - | - | - | - | - |
| **CO5** | 3 | 3 | 3 | - | 2 | - | - | - | - | - | - | - | - | - | - |

| COURSE CONTENT | |
|---|---|
| **UNIT I** | **Introduction:** Functional elements of an instrument, generalized performance characteristics of instruments – static characteristics, dynamic characteristics. Zero order, first order, second order instruments – step response, ramp response and impulse response. Response of general form of instruments to periodic input and to transient input |
| **UNIT II** | **Transducers for motion and dimensional measurements:** Relative displacement, translation and rotational resistive potentiometers, resistance strain gauges, LVDT, synchros, capacitance transducers, Piezo-electric transducers, electro-optical devices, nozzle – flapper transducers, digital displacement transducers, ultrasonic transducers, Gyroscopic sensors |
| **UNIT III** | **Transducers For Force Measurement**: Bonded strain gauge transducers, Photo-electric transducers, variable reluctance pickup, torque measurement dynamometers. **Transducers For Flow Measurement:** Hot wire and hot-film anemometers, Electro-magnetic flow meters, laser Doppler velocity meter **Transducers For Pressure Measurement:** Manometers, elastic transducers, liquid systems, gas systems, very high pressure transducers. |
| **UNIT IV** | **Transducers For Temperature Measurement:** Thermal expansion methods, Thermometers (liquid in glass), pressure thermometers, Thermocouples, Materials configuration and techniques. Resistance thermometers, Thermistors, junction semiconductors, Sensors, Radiation methods, Optical pyrometers, Dynamic response of temperature sensors heat flux Sensors, Transducers for liquid level measurement, humidity, silicon and quartz sensors, fiber optic sensors. |
| **UNIT V** | **Smart sensors:** Introduction – Primary Sensors – Excitation – Amplification – Filters – Converters – Compensation– Information Coding/Processing - Data Communication – Standards for Smart Sensor Interface – The Automation Sensors –Applications: Introduction – On-board Automobile Sensors (Automotive Sensors)– Home Appliance Sensors – Aerospace Sensors –– Sensors for Manufacturing –Sensors for Environmental Monitoring |

| TEXT BOOKS | |
|---|---|
| **1.** | Sensors and Transducers, D. Paranaiba ,PHI Learning Private Limited. |
| **2.** | Mechatronics,W. Bolton ,Pearson Education Limited. |
| **REFERENCE BOOKS** | |
| **1.** | Transducers and Instrumentation, by D.V.S. Murthy (PHI) |
| **2.** | Instrumentation Measurement & Analysis, by B.C. Nakra, K.K. Choudry, (TMH) |
| **WEB RESOURCES** | |
| **1.** | https://youtu.be/hv-aBonZMRQ |
| **2.** | https://www.youtube.com/watch?v=qSa3GNjIyy0 |

# Computer Networks Laboratory using C

**CSE, CSE(AI), CSE(AI&ML), CSE(DS), IT**

| | | | |
|---|---|---|---|
| **Course Category** | Program Core | **Course Code** | 20CS5L09 |
| **Course Type** | Laboratory | **L-T-P-C** | 0-0-3-1.5 |
| **Prerequisites** | | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 15<br>35<br>50 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | Learn basic concepts of computer networking and acquire practical notions of protocols with the emphasis on TCP/IP. A lab provides a practical approach to Ethernet/Internet networking: networks are assembled, and experiments are made to understand the layered architecture and how do some important protocols work |

| **COURSE OUTCOMES** | | **BTL** |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | |
| **CO1** | Develop various data link layer functionalities | K3 |
| **CO2** | Analyze and identify appropriate routing algorithm for the network | K4 |
| **CO3** | Analyze the network simulations in NS2 | K4 |

**Note:** K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 0 |
| **CO2** | 3 | 3 | 3 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 0 |
| **CO3** | 3 | 3 | 3 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 0 |

| COURSE CONTENT | |
|---|---|
| **List of Experiments** | |
| 1 | Study of Network devices in detail and connect the computers in Local Area Network. |
| 2 | Write a Program to implement the data link layer farming methods such as<br>i) Character stuffing ii) bit stuffing. |
| 3 | Write a Program to implement data link layer farming method checksum. |
| 4 | Write a program for Hamming Code generation for error detection and correction. |
| 5 | Write a Program to implement on a data set of characters the three CRC polynomials – CRC 12, CRC 16 and CRC CCIP. |
| 6 | Write a Program to implement Sliding window protocol for Goback N. |
| 7 | Write a Program to implement Sliding window protocol for Selective repeat. |
| 8 | Write a Program to implement Stop and Wait Protocol. |
| 9 | Write a program for congestion control using leaky bucket algorithm |
| 10 | Write a Program to implement Dijkstra_s algorithm to compute the Shortest path through a graph. |
| 11 | Write a Program to implement Distance vector routing algorithm by obtaining routing table at each node (Take an example subnet graph with weights indicating delay between nodes). |
| 12 | Write a Program to implement Broadcast tree by taking subnet of hosts. |
| 13 | Wireshark<br>i. Packet Capture Using Wire shark<br>ii. Starting Wire shark<br>iii. Viewing Captured Traffic<br>iv. Analysis and Statistics & Filters. |
| 14 | Execution of Nmap scan |
| 15 | Operating System Detection using Nmap |
| 16 | Do the following using NS2 Simulator<br>i. NS2 Simulator-Introduction<br>ii. Simulate to Find the Number of Packets Dropped<br>iii. Simulate to Find the Number of Packets Dropped by TCP/UDP<br>iv. Simulate to Find the Number of Packets Dropped due to Congestion<br>v. Simulate to Compare Data Rate& Throughput. |

# PRAGATI ENGINEERING COLLEGE
## (Autonomous)
## B.Tech
## Computer Science and Engineering (Artificial Intelligence & Machine Learning)

**R-20**

**Algorithms for Efficient Coding Laboratory using C**

**CSE ( AI ML)**

**III** **B. Tech II Semester**

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 20AM6L03 |
| **Course Type** | Laboratory | **L-T-P-C** | 0-0-3-1.5 |
| **Prerequisites** | C Programming | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 15<br>35<br>50 |

| **COURSE OBJECTIVES** | |
|---|---|
| **The student will:** | |
| **1** | To develop efficient coding for the algorithms with various inputs and algorithms. |

| **COURSE OUTCOMES** | | |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | **Cognitive Level** |
| **CO1** | Analyze the program execution time. | K4 |
| **CO2** | Analyze how to get the time complexity of the programs. | K4 |
| **CO3** | Implementation of various programs on Dynamic Programming, Back Tracking etc… | K3 |

**K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.**

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

| | **PO 1** | **PO 2** | **PO3** | **PO4** | **PO 5** | **PO6** | **PO 7** | **PO 8** | **PO 9** | **PO1 0** | **PO1 1** | **PO12** | **PSO 1** | **PSO 2** | **PSO 3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 1 | 1 | 1 | -- | -- | -- | -- | -- | -- | -- | 2 | 2 | 3 |
| **CO2** | 3 | 2 | 1 | 1 | 1 | -- | -- | -- | -- | -- | -- | -- | 2 | 2 | 3 |
| **CO3** | 2 | 2 | 1 | 1 | 1 | -- | -- | -- | -- | -- | -- | -- | 2 | 2 | 2 |

| List of Experiments | |
|---|---|
| 1 | Develop a program and measure the running time for Binary Search with Divide andConquer. |
| 2 | Develop a program and measure the running time for Merge Sort with Divide and Conquer. |
| 3 | Develop a program and measure the running time for Quick Sort with Divide and Conquer. |
| 4 | Develop a program and measure the running time for estimating minimum-cost spanningTrees with Greedy Method. |
| 5 | Develop a program and measure the running time for estimating Single Source Shortest Pathswith Greedy Method. |
| 6 | Develop a program and measure the running time for optimal Binary search trees with Dynamic Programming. |
| 7 | Develop a program and measure the running time for identifying solution for traveling sales person problem with Dynamic Programming.. |
| 8 | Develop a program and measure the running time for identifying solution for 8-Queensproblem with Backtracking. |
| 9 | Develop a program and measure the running time for Graph Coloring with Backtracking.. |
| 10 | Develop a program and measure the running time to generate solution of Hamiltonian Cycleproblem with Backtracking. |
| 11 | Develop a program and measure the running time running time to generate solution ofKnapsack problem with Backtracking. |

# PRAGATI ENGINEERING COLLEGE
## (Autonomous)
## B.Tech
## Computer Science and Engineering (Artificial Intelligence & Machine Learning)

**R-20**

## Deep Learning with Tensorflow Laboratory
**Common to CSE (AI ML), CSE (AI) and CSE (DS)**

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 20AM6L04 |
| **Course Type** | Laboratory | **L-T-P-C** | 0-0-3-1.5 |
| **Prerequisites** | Python Programming | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 15<br>35<br>50 |

| **COURSE OBJECTIVES** | |
|---|---|
| **The student will:** | |
| **1** | Have a better knowledge about softwares like Keras, Tensorflow etc… |

| **COURSE OUTCOMES** | | |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | **Cognitive Level** |
| **CO1** | Implement deep neural networks to solve real world problems. | K1 |
| **CO2** | Choose appropriate pre-trained model to solve real time problem. | K2 |
| **CO3** | Interpret the results of two different deep learning models. | K3 |

**K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.**

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

| | **PO1** | **PO 2** | **PO 3** | **PO4** | **PO 5** | **PO6** | **PO 7** | **PO 8** | **PO 9** | **PO10** | **PO11** | **PO12** | **PSO 1** | **PSO 2** | **PS O3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 1 | 1 | 1 | -- | -- | -- | -- | -- | -- | -- | 2 | 2 | 3 |
| **CO2** | 2 | 2 | 1 | 1 | 1 | -- | -- | -- | -- | -- | -- | -- | 2 | 2 | 2 |
| **CO3** | 2 | 2 | 1 | 1 | 1 | -- | -- | -- | -- | -- | -- | -- | 2 | 2 | 2 |

## Software Packages required:

- **Keras**
- Tensorflow
- **PyTorch**

| List of Experiments | |
|---|---|
| 1 | Implement multilayer perceptron algorithm for MNIST Hand written Digit Classification.. |
| 2 | Design a neural network for classifying movie reviews (Binary Classification) using IMDBdataset. |
| 3 | Design a neural Network for classifying news wires (Multi class classification) using Reutersdataset. |
| 4 | Design a neural network for predicting house prices using Boston Housing Price dataset. |
| 5 | Build a Convolution Neural Network for MNIST Hand written Digit Classification. |
| 6 | Build a Convolution Neural Network for simple image (dogs and Cats) Classification. |
| 7 | Use a pre-trained convolution neural network (VGG16) for image classification. |
| 8 | Implement one hot encoding of words or characters. |
| 9 | Implement word embeddings for IMDB dataset. |
| 10 | Implement a Recurrent Neural Network for IMDB movie review classification problem. |

## Text Books:

1. Reza Zadeh and BharathRamsundar, “Tensorflow for Deep Learning”, O’Reilly publishers,2018

## References:

1. https://github.com/fchollet/deep-learning-with-python-notebooks

# PRAGATI ENGINEERING COLLEGE
## (Autonomous)
### B.Tech
### Computer Science and Engineering (Artificial Intelligence & Machine Learning)

**R-20**

## Skill Oriented Course
## Soft Skills and Inter personal Communication

| | | | |
|---|---|---|---|
| **Course Category** | Skill Oriented Course | **Course Code** | 20HE6S01 |
| **Course Type** | Laboratory | **L-T-P-C** | 1 – 0 – 2 – 2 |
| **Prerequisites** | | **Total Marks** | 50 |

| **COURSE OUTCOMES** | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Understand the significance of soft skills and its importance towards his goal setting. |
| **CO2** | Develop interpersonal relations through effective communication and public speaking. |
| **CO3** | Build confidence exercising verbal and non-verbal techniques with analytical skills for his success. |
| **CO4** | Utilize various skills required to become a good leader and thorough professional. |
| **CO5** | Improve decision-making skills and problem-solving skills with emotional intelligence. |

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

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

| COURSE CONTENT | |
|---|---|
| **UNIT - I** | 1. Soft Skills: An Introduction – Definition and Significance of Soft Skills; Process, Importance and Measurement of Soft Skill Development.<br>2. Self-Discovery: Discovering the Self; Setting Goals; Beliefs, Values, Attitude, Virtue.<br>3. Positivity and Motivation: Developing Positive Thinking and Attitude; Driving out Negativity; Meaning and Theories of Motivation; Enhancing Motivation Levels. |
| **UNIT-II** | 1. Interpersonal Communication: Interpersonal relations; communication models, process and barriers; team communication; developing interpersonal relationships through effective communication; listening skills; essential formal writing skills; corporate communication styles – assertion, persuasion, negotiation.<br>2. Public Speaking: Skills, Methods, Strategies and Essential tips for effective public speaking.<br>3. Non-Verbal Communication: Importance and Elements; Body Language. |
| **UNIT-III** | 1. Presentation Skills: Types, Content, Audience Analysis, Essential Tips – Before, During and After, Overcoming Nervousness.<br>2. Group Discussion: Importance, Planning, Elements, Skills assessed; effectively disagreeing, Initiating, Summarizing and Attaining the Objective.<br>3. Interview Skills: Interviewer and Interviewee – in-depth perspectives. Before, During and After the Interview. Tips for Success.<br>4. Teamwork and Leadership Skills: Concept of Teams; Building effective teams; Concept of Leadership and honing Leadership skills |
| **UNIT - IV** | 1. Etiquette and Manners – Social and Business.<br>2. Time Management – Concept, Essentials, Tips.<br>3. Personality Development – Meaning, Nature, Features, Stages, Models; Learning Skills; Adaptability Skills.<br>4. Leadership and Assertiveness Skills: A Good Leader; Leaders and Managers; Leadership Theories; Types of Leaders; Leadership Behaviour; Assertiveness Skills. |
| **UNIT- V** | 1. Emotional Intelligence: Meaning, History, Features, Components, Intrapersonal and Management Excellence; Strategies to enhance Emotional Intelligence |

| | |
|---|---|
| | 2. Conflict Management: Conflict - Definition, Nature, Types and Causes; Methods<br>3. Decision-Making and Problem-Solving Skills: Meaning, Typesand Models, Group and Ethical Decision-Making, Problems and Dilemmas in application of these skills.<br>4. Stress Management: Stress - Definition, Nature, Types, Symptoms and Causes; Stress Analysis Models and Impact of Stress; Measurement and Management of Stress. |

| **Text books :** | |
|---|---|
| **1.** | Managing Soft Skills for Personality Development – edited by B.N.Ghosh, McGraw Hill India, 2012. |
| **2.** | English and Soft Skills – S.P.Dhanavel, Orient Blackswan India, 2010 |

| **WEB RESOURCES** | |
|---|---|
| 1. | https://nptel.ac.in/courses/109107121/ |
| 2. | https://www.goskills.com/Soft-Skills |

# Employability Skills – II

**Common for CSE, CSE AI&ML, CSE DS, CSE AI, and IT Branches.**

| | | | |
|---|---|---|---|
| **Course Category** | Humanities | **Course Code** | **20HE6T03** |
| **Course Type** | Theory | **L-T-P-C** | 2 – 0 – 0 – 0 |
| **Prerequisites** | Basic Language Knowledge. | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

**COURSE OBJECTIVE:**

| | |
|---|---|
| **1** | To present language ability in the interview for employment. |

| **COURSE OUTCOMES** | | **LEVEL** |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | |
| **CO1** | Endues an ability of an accurate usage of words in language. | **K -II** |
| **CO2** | Develops logical inter-relation of words in usage. | **K -II** |
| **CO3** | Helps to develop compendious usage in communication. | **K -II** |
| **CO4** | Determines to concentrate on Non-Verbal interpretation. | **K -I** |
| **CO5** | Enriches the ability in vocabulary usage. | **K-I** |

**(K1 – Remember, K2 – Understand, K-3 Apply, K4 -Analysis, K5 – Evaluate, K6 – Create)**
**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| **CO2** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| **CO3** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| **CO4** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| **CO5** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |

| COURSE CONTENT | |
|---|---|
| **UNIT I** | **Words often confused.**<br>Commonly Confused Words – Homonym – Homograph- Homophone. |
| **UNIT II** | **Analogies/Jumbled Sentences**<br>Opposite Analogy - Cause and Effect Analogy - Problem and Solution Analogy - Effort and Result Analogy. Spotting the transition words or the linking words- Identify the Theme of the paragraph. |
| **UNIT III** | **One-word substitutions, sentence corrections**<br>Subject-Verb Agreement -Verb form- Logical Predication and Modifiers – Comparisons. |
| **UNIT IV** | **Body Language**<br>Facial expressions - Body movement and posture – Gestures - Eye contact – Space – Voice. |
| **UNIT V** | **Development of Verbal Ability.**<br>Vocabulary- Word analogy – Antonyms and Synonyms -<br>Ve rba l C ohe re nc e & C ohe si on |

| TEXT BOOKS | |
|---|---|
| **1.** | **Teaching Offender Education: Employability Activities: 14 Activities to Develop the Soft Skills for Working Life** by Teresa Maria O'Hara, Nutcracker Press UK. |
| **2.** | **BEST: Basic Employability Skills Training: Volume 1** by Sally J. Vonada |
| **3.** | **Skills** by Dr. Rabindranath Athri |
| **WEB RESOURCES** | |
| **1.** | https://www.collegiateparent.com/academics/build-employable-skill-sets-online/ |
| **2.** | https://cte.ed.gov/initiatives/employability-skills-framework |
| **3.** | https://www.collegiateparent.com/academics/build-employable-skill-sets-online/ |
| **4.** | https://www.skillsyouneed.com/general/employability-skills.html |
| **5.** | https://www.realityworks.com/product/online-employability-skills-programs/ |

# PRAGATI ENGINEERING COLLEGE
## (Autonomous)
### B.Tech
### Computer Science and Engineering (Artificial Intelligence & Machine Learning)

**R-20**

## Professional Elective – III

## Reinforcement Learning

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 20AM7T06 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | Machine Learning | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **The student will:** | |
| **1** | Learn various approaches to solve decision problems with functional models and algorithmsfor task formulation, Tabular based solutions, Function approximation solutions, policy gradients and model based reinforcement learning. |
| **2** | Learn Various policies regarding Dynamic Programming. |
| **3** | Learn the various methods of MonteCarlo Methods. |
| **4** | Learn about various methods in Off – policy with approximation. |
| **5** | Learn the various Policy Gradient Methods and its applications. |

| **COURSE OUTCOMES** | | |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | **Cognitive Level** |
| **CO1** | Remember the basic concepts of Reinforcement learning. | K1 |
| **CO2** | Understand basic concepts of Dynamic Programming**.** | K2 |
| **CO3** | Understand various methods and applications of reinforcement learning. | K2 |
| **CO4** | Analyze various off-policy methods with approximations. | K4 |
| **CO5** | Understand about Policy Gradient Methods. | K2 |

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

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

| COURSE CONTENT | |
|---|---|
| **UNIT-I** | Introduction: Reinforcement Learning, Examples, Elements of Reinforcement Learning, Limitations and Scope, An Extended Example: Tic-Tac-Toe<br>Multi-armed Bandits: A k-armed Bandit Problem, Action-value methods, The 10-armed Testbed, Incremental Implementation, Tracking a Nonstationary Problem, Optimistic Initial Values, Upper – Confidence-Bound Action Selection, Gradient Bandit Algorithm |
| **UNIT-II** | Finite Markov Decision Process: The Agent-Environment Interface, Goals and Rewards, Returns and Episodes, Unified Notataion for Episodic and Continuing Tasks, Policies and Value Functions, Dynamic Programming: Policy Evaluation, Policy Improvement, Policy Iteration, Value Iteration, Asynchronous<br>Dynamic Programming, Generalized Policy Iteration, Efficiency of DynamicProgramming |
| **UNIT-III** | Monte Carlo Methods: Monte Carlo Prediction, Monte Carlo Estimation of Action Values, Monte Carlo Control, Monte Carlo Control without Exploring Starts, Off-policy Prediction via Importance Sampling, Incremental Implementation, Discontinuing-aware Importance Sampling, Per-decision Importance Sampling n-step Bootstrapping: n-step TD Prediction, n-step Sarsa, n-step Off-policy Learning, Per-decision methods with Control Variables, A Unifying Algorithm: n-step Q(σ) |
| **UNIT-IV** | Off-policy Methods with Approximation: Semi-gradient Methods, Examples of Off-policy Divergence, The Deadly Triad, Linear Value-function Geometry, Gradient Descent in the Bellman Error, The Bellman Error is not Learnable, Gradient-TD methods, Emphatic-TD methods, Reducing Variance<br>Eligibility Traces: The λ-return, TD(λ), n-step Truncated λ-return methods, Online λ –return Algorithm, True Online TD(λ), Dutch Traces in Monte Carlo Learning, Sarsa(λ), Variable λ and γ, Off-policy Traces with Control Variables, Watkins's Q(λ) to Tree-Backup(λ) |
| **UNIT-V** | **Policy Gradient Methods**: Policy Approximation and its Advantages, The Policy Gradient Theorem, REINFOECE - Monte Carlo Policy Gradient, REINFORCE with Baseline, Actor-Critic Methods,Policy Gradient for Continuing Problems, Policy Parameterization fr Continuous Actions Applications and Case Studies: TD-Gammon, Samuel's Checkers Player, Watson's Daily Double Wagering, Optimizing Memory Control, Personalized Web Services |

| TEXT BOOKS | |
|---|---|
| **1.** | R. S. Sutton and A. G. Bart,. "Reinforcement Learning - An Introduction," MIT Press, 2018. |
| **2.** | Szepesvári, Csaba, "Algorithms for Reinforcement Learning," United States: Morgan & Claypool, 2010. |
| **REFERENCE BOOKS** | |
| **1.** | Puterman, Martin L., "Markov Decision Processes: Discrete Stochastic Dynamic Programming," Germany: Wiley, 2014. |
| **WEB RESOURCES:** | |
| **1** | Swayam NPTEL: https://onlinecourses.nptel.ac.in/noc20_cs74/preview |
| **2** | https://www.coursera.org/learn/fundamentals-of-reinforcement-learning |

# PRAGATI ENGINEERING COLLEGE
## (Autonomous)
## B.Tech
## Computer Science and Engineering (Artificial Intelligence & Machine Learning)

**R-20**

**Soft Computing**

**Common to CSE (AI) and CSE (AI&ML)**

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 20AI7T05 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **The student will:** | |
| **1** | Artificial Intelligence, Various types of production systems, characteristics of production systems. |
| **2** | Neural Networks, architecture, functions and various algorithms involved. |
| **3** | Fuzzy Logic, Various fuzzy systems and their functions |
| **4** | Genetic algorithms, its applications and advances. |

| **COURSE OUTCOMES** | | |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | **Cognitive Level** |
| **CO1** | Learn about soft computing techniques and their applications | K2 |
| **CO2** | Analyze various neural network architectures | K4 |
| **CO3** | Understand perceptrons and counter propagation networks. | K2 |
| **CO4** | Define the fuzzy systems | K1 |
| **CO5** | Analyze the genetic algorithms and their applications. | K4 |

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

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

| COURSE CONTENT | |
|---|---|
| **UNIT-I** | **Fuzzy Set Theory:** Introduction to Neuro – Fuzzy and Soft Computing, Fuzzy Sets, Basic Definition and Terminology, Set-theoretic Operations, Member Function Formulation and Parameterization, Fuzzy Rules and Fuzzy Reasoning, Extension Principle and Fuzzy Relations. Fuzzy Inference Systems, Mamdani Fuzzy Models, Sugeno Fuzzy Models. |
| **UNIT-II** | **Optimization:** Derivative based Optimization, Descent Methods, The Method ofSteepest Descent, Classical Newton's Method, Step Size Determination, Derivative-free Optimization, Genetic Algorithms. |
| **UNIT-III** | **Artificial Intelligence:** Introduction, Knowledge Representation, Reasoning, Issues and Acquisition: Prepositional and Predicate Calculus Rule Based knowledge Representation Symbolic Reasoning, Heuristic Search: Techniques for Heuristic search Heuristic Classification. |
| **UNIT-IV** | **Neuro Fuzzy Modeling:** Adaptive Neuro-Fuzzy Inference Systems, Architecture, Hybrid Learning Algorithm, Learning Methods that Cross-fertilize ANFIS and RBFN, Framework Neuron Functions for Adaptive Networks, Neuro Fuzzy Spectrum. |
| **UNIT-V** | **Applications Of Computational Intelligence:** Printed Character Recognition, Inverse Kinematics Problems, Automobile Fuel Efficiency Prediction, Soft Computing for Color Recipe Prediction. |

| **TEXT BOOKS** | |
|---|---|
| **1.** | J.S.R.Jang, C.T.Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI, 2004, Pearson Education 2004 |
| **2.** | N.P.Padhy, "Artificial Intelligence and Intelligent Systems", Oxford University Press, 2006. |
| **REFERENCE BOOKS** | |
| **1.** | Elaine Rich & Kevin Knight, Artificial Intelligence, Second Edition, Tata Mcgraw Hill Publishing Comp., 2006, New Delhi. |
| **2.** | Timothy J.Ross, "Fuzzy Logic with Engineering Applications", McGraw-Hill, 1997. |
| **3.** | Davis E.Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley, N.Y., 1989. |
| **4.** | S. Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI, |
| **5.** | R.Eberhart, P.Simpson and R.Dobbins, "Computational Intelligence - PC Tools", AP Professional, Boston, 1996. |
| **6.** | AmitKonar, "Artificial Intelligence and Soft Computing Behaviour and Cognitive model of the human brain", CRC Press, 2008 |
| **WEB RESOURCES:** | |
| **1** | www.myreaders.info/html/soft_computing.html |

# PRAGATI ENGINEERING COLLEGE
## (Autonomous)
## B.Tech
## Computer Science and Engineering (Artificial Intelligence & Machine Learning)

**R-20**

# BlockChain Technologies

| | | | |
|---|---|---|---|
| **Course Category** | Professional Elective | **Course Code** | 20IT7T16 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | **30**<br>**70**<br>**100** |

**COURSE OBJECTIVES**
The objective of the course is to

| | |
|---|---|
| **1** | To understand block chain technology and Crypto currency works |

| **COURSE OUTCOMES** | | **Cognitive level** |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | |
| **CO1** | Demonstrate the block chain basics, Crypto currency | K2 |
| **CO2** | To compare and contrast the use of different private vs. public block chain and use cases | K2 |
| **CO3** | Design an innovative Bit coin Block chain and scripts, Block chain Science on varies coins | K3 |
| **CO4** | Classify Permission Block chain and use cases – Hyper ledger, Corda | K2 |
| **CO5** | Make Use of Block-chain in E-Governance, Land Registration, Medical Information Systems and others | K2 |

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

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

| COURSE CONTENT | |
|---|---|
| **UNIT I** | **Introduction:** Introduction, basic ideas behind block chain, how it is changing the landscape of digitalization, introduction to cryptographic concepts required, Block chain or distributed trust, Currency, Cryptocurrency, How a Cryptocurrency works, Financial services, Bitcoin prediction markets. |
| **UNIT II** | Hashing, public key cryptosystems, private vs public block chain and use cases, Hash Puzzles, Extensibility of Block chain concepts, Digital Identity verification, Block chain Neutrality, Digital art, Block chain Environment |
| **UNIT III** | **Introduction to Bitcoin:** Bitcoin Block chain and scripts, Use cases of Bitcoin Blockchain scripting language in micropayment, escrow etc. Downside of Bit coin mining, Block chain Science: Grid coin, Folding coin, Block chain Genomics. |
| **UNIT IV** | Ethereum, IOTA, The real need for mining, consensus, Byzantine Generals Problem, and Consensus as a distributed coordination problem, Coming to private or permissioned block chains, Introduction to Hyper ledger, Currency, Token, Campus coin, Coin drop as a strategy for Public adoption, Currency Multiplicity, Demurrage currency |
| **UNIT V** | Technical challenges, Business model challenges, Scandals and Public perception, Government Regulations, Uses of Block chain in E-Governance, Land Registration, Medical Information Systems, Supply chain management. |
| **TEXT BOOKS** | |
| **1.** | Blockchain Blue print for Economy by Melanie Swan |
| **REFERENCE BOOKS** | |
| **1.** | Blockchain Basics: A Non-Technical Introduction in 25 Steps, 1st Edition, by Daniel Drescher |
| **WEB RESOURCES** | |
| **1.** | https://www.classcentral.com/course/edx-social-network-analysis-sna-9134 |
| **2.** | https://www.coursera.org/learn/social-network-analysis |

# PRAGATI ENGINEERING COLLEGE
## (Autonomous)
### B.Tech
### Computer Science and Engineering (Artificial Intelligence & Machine Learning)

**R-20**

## Speech Processing
**Common to CSE (AI) and CSE (AI&ML)**

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 20AI7T06 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **The student will:** | |
| **1** | To introduce speech production and related parameters of speech. |
| **2** | To show the computation and use of techniques such as short time Fourier transform, linear predictive coefficients and other coefficients in the analysis of speech. |
| **3** | To understand different speech modeling procedures such as Markov and their implementation issues. |

| **COURSE OUTCOMES** | | |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | **Cognitive Level** |
| **CO1** | Model speech production system and describe the fundamentals of speech. | K3 |
| **CO2** | Extract and compare different speech parameters. | K2 |
| **CO3** | Choose an appropriate statistical speech model for a given application. | K1 |
| **CO4** | Design a speech recognition system. | K3 |
| **CO5** | Use different speech synthesis techniques. | K2 |

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

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

| COURSE CONTENT | |
|---|---|
| **UNIT-I** | **Fundamentals of Digital Speech Processing:** Anatomy & Physiology of Speech Organs, The process of Speech Production, Acoustic Phonetics, Articulatory Phonetics, The Acoustic Theory of Speech Production- Uniform lossless tube model, effect of losses in vocal tract, effect of radiation at lips, Digital models for speech signals. |
| **UNIT-II** | **Time Domain Models for Speech Processing:** Introduction- Window considerations, Short time energy and average magnitude Short time average zero crossing rate, Speech Vs Silence discrimination using energy and zero crossing, Pitch period estimation using a parallel processing approach, The short time autocorrelation function, The short time average magnitude difference function, Pitch period estimation using the autocorrelation function. |
| **UNIT-III** | **Linear Predictive Coding (LPC) Analysis:** Basic principles of Linear Predictive Analysis: The Autocorrelation Method, The Covariance Method, Solution of LPC Equations: Cholesky Decomposition Solution for Covariance Method, Durbin's Recursive Solution for the Autocorrelation Equations, Comparison between the Methods of Solution of the LPC Analysis Equations, Applications of LPC Parameters: Pitch Detection using LPC Parameters, Formant Analysis using LPC Parameters. |
| **UNIT-IV** | **Homomorphic Speech Processing:** Introduction, Homomorphic Systems for Convolution: Properties of the Complex Cepstrum, Computational Considerations, The Complex Cepstrum of Speech, Pitch Detection, Formant Estimation, The Homomorphic Vocoder. Speech Enhancement: Nature of interfering sounds, Speech enhancement techniques: Single Microphone Approach : spectral subtraction, Enhancement by re-synthesis, Comb filter, Wiener filter, Multi microphone Approach |
| **UNIT-V** | **Automatic Speech:** Basic pattern recognition approaches, Parametric representation of speech, Evaluating the similarity of speech patterns, Isolated digit Recognition System, Continuous digit Recognition System. Hidden Markov Model (HMM) for Speech: Hidden Markov Model (HMM) for speech recognition, Viterbi algorithm, Training and testing using HMMS. |

| TEXT BOOKS | |
|---|---|
| **1.** | L.R. Rabiner and S. W. Schafer, "Digital Processing of Speech Signals", Pearson Education. |
| **2.** | Douglas O'Shaughnessy, "Speech Communications: Human & Machine", 2nd Ed., Wiley India, 2000. |
| **REFERENCE BOOKS** | |
| **1.** | L.R Rabinar and R W Jhaung, "Digital Processing of Speech Signals", 1978, Pearson Education. |
| **2.** | Thomas F. Quateri, "Discrete Time Speech Signal Processing: Principles and Practice", 1st Edition., PE. |
| **3.** | Ben Gold & Nelson Morgan, "Speech & Audio Signal Processing", 1st Edition, Wiley |
| **WEB RESOURCES:** | |
| **1** | Speech & Audio Processing \| Tutorial Lessons \| JCBRO (jcbrolabs.org) |

**Professional Elective – IV**

**Cloud Computing**

**Common to CSE, CSE(AI), CSE(AI&ML), CSE(DS), IT, EEE**

| | | | |
|---|---|---|---|
| **Course Category** | Professional Elective | **Course Code** | 20CS7T12 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To explain the evolving computer model caned cloud computing |
| **2** | To introduce the various levels of services that can be achieved by cloud |
| **3** | To describe the security aspects in cloud |

| **COURSE OUTCOMES** | | **BTL** |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | |
| **CO1** | Illustrate the key dimensions of the challenge of Cloud Computing | K2 |
| **CO2** | Classify the Levels of Virtualization and mechanism of tools | K3 |
| **CO3** | Analyze Cloud infrastructure including Google Cloud and Amazon Cloud | K4 |
| **CO4** | Design Combinatorial Auctions for cloud resource and design scheduling algorithms for computing cloud | K3 |
| **CO5** | Analyze control storage systems and cloud security, the risks involved its impact and develop cloud application | K4 |

**Note:** K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

| | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PS O1** | **PS O2** | **PS O3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 1 | 3 | 1 | 3 | - | - | - | - | - | - | - | 3 | 3 | 3 |
| **CO2** | 2 | 1 | 3 | 1 | 3 | - | - | - | - | - | - | - | 3 | 3 | 3 |
| **CO3** | 2 | 1 | 3 | 1 | 3 | - | - | - | - | - | - | - | 3 | 3 | 3 |
| **CO4** | 2 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 3 | 3 | 3 |
| **CO5** | 2 | 1 | 3 | 3 | 3 | - | - | - | - | - | - | - | 3 | 3 | 3 |

| COURSE CONTENT | |
|---|---|
| **UNIT I** | **Systems Modeling, Clustering and Virtualization:** Scalable Computing over the Internet-The Age of Internet Computing, Scalable computing over the internet, Technologies for Network Based Systems, System models for Distributed and Cloud Computing, , Performance, Security and Energy Efficiency |
| **UNIT II** | **Virtual Machines and Virtualization of Clusters and Data Centers:** Implementation Levels of Virtualization, Virtualization Structures/ Tools and Mechanisms, Virtualization of CPU, Memory and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data-Center Automation. |
| **UNIT III** | **Cloud Platform Architecture:** Cloud Computing and Service Models, Public Cloud Platforms, Service Oriented Architecture, Programming on Amazon AWS and Microsoft Azure |
| **UNIT IV** | **Cloud Resource Management and Scheduling:** Policies and Mechanisms for Resource Management, Applications of Control Theory to Task Scheduling on a Cloud, Stability of a Two Level Resource Allocation Architecture, Feedback Control Based on Dynamic Thresholds. Coordination of Specialized Autonomic Performance Managers, Resource Bundling, Scheduling Algorithms for Computing Clouds-Fair Queuing, Start Time Fair Queuing. |
| **UNIT V** | **Storage Systems:** Evolution of storage technology, storage models, file systems and database, distributed file systems, general parallel file systems. Google file system. |

| TEXT BOOKS | |
|---|---|
| **1.** | Cloud Computing, Theory and Practice, Dan C Marinescu, MK Elsevier,2014 |
| **REFERENCE BOOKS** | |
| **1.** | Distributed and Cloud Computing, Kai Hwang, Geoffry C. Fox, Jack J. Dongarra MK Elsevier,First Edition,2013 |
| **2.** | Cloud Computing, A Hands on approach, ArshadeepBahga, Vijay Madisetti, University Press,2014 |
| **3.** | Cloud Computing, A Practical Approach, Anthony T Velte, Toby J Velte, Robert Elsenpeter, TMH,2009 |
| **4.** | Mastering Cloud Computing, Foundations and Application Programming, Raj Kumar Buyya, Christen vecctiola, S Tammaraiselvi, TMH |
| **WEB RESOURCES** | |
| **1.** | https://onlinecourses.nptel.ac.in/noc22_cs20/preview |

# PRAGATI ENGINEERING COLLEGE
## (Autonomous)
### B.Tech
### Computer Science and Engineering (Artificial Intelligence & Machine Learning)

**R-20**

# Big Data Analytics

**Common to CSE, IT, CSE(AI&ML), CSE(AI), CSE(DS)**

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | **20DS6T02** |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | Data Mining | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | **30**<br>**70**<br>**100** |

| **COURSEOBJECTIVES** | |
|---|---|
| **1** | To optimize business decisions and create competitive advantage with Big Data analytics |
| **2** | To learn to analyze the big data using intelligent techniques |
| **3** | To introduce programming tools PIG & HIVE in Hadoop echo system |

| **COURSEOUTCOMES**<br>**Upon successful completion of the course, the student will be able to:** | | **Cognitive level** |
|---|---|---|
| **CO1** | Illustrate big data challenges in different domains including social media, transportation, finance and medicine | K2 |
| **CO2** | Enumerate and apply the features of Cassandra | K2 |
| **CO3** | Design and develop Hadoop and Map Reduce programs | K3 |
| **CO4** | Perform data analysis using Apache Spark | K2 |
| **CO5** | Analyze the data analytics process with a case study | K3 |

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

**Contribution of Course Outcomes towards achievement of Program Outcomes (1–Low,2-Medium,3– High)**

| **CO** | **PO** | | | | | | | | | | | | **PSO** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** | **3** |
| **1** | 3 | 3 | 2 | 2 | 2 | - | - | - | - | - | - | - | 1 | 1 | 1 |
| **2** | 3 | 1 | 1 | 2 | 2 | - | - | - | - | - | - | 1 | - | - | 1 |
| **3** | 3 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | 1 | 2 | 2 | 1 |
| **4** | 3 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | 1 | 2 | 2 | 1 |
| **5** | 3 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | 1 | 2 | 2 | 1 |

| COURSECONTENT | |
|---|---|
| **UNIT I** | **Types of Digital Data:** Classification of Digital Data. Introduction to Big Data: Characteristic of Data, Evolution of Big Data, Definition of Big Data, Challenges with Big Data, What is Big Data?<br>**Big Data Analytics:** Where do we Begin?, What is Big Data Analytics?, What Big Data Analytics isn't?, Classification of Analytics, Terminologies Used in Big Data Environments. The Big Data Technology Landscape: NoSQL. **(Text Book 1)** |
| **UNIT II** | **Introduction to Cassandra:** Apache Cassandra – An Introduction, Features of Cassandra, CQL Data Types, CQLSH, Keyspaces, CRUD, Collections, Using a Counter, Time to Live, Alter Commands, Import and Export. **(Text Book 1)** |
| **UNIT III** | **Hadoop** : Hadoop Overview, HDFS (Hadoop Distributed File System),Processing Data with Hadoop, Managing Resources and Applications with Hadoop YARN (Yet another Resource Negotiator).<br>**MAPREDUCE:** Introduction to MAPREDUCE Programming: Introduction, Mapper, Reducer, Combiner, Partitioner, Searching, Sorting, Compression. **(Text Book 1)** |
| **UNIT IV** | **Introduction to Data Analysis with Spark**: What is Apache Spark, A unified Spark, Who uses Spark and for what?, A Brief History of Spark, Spark version and releases, Storage layers for Spark.<br>**Programming with RDDs:** RDD Basics, Creating RDDs, RDD Operations, Passing functions to Spark, Common Transformations and Actions, Persistence. **(Text Book 2)** |
| **UNIT V** | **JasperReport using Jaspersoft:** Introduction to JasperReports, Connecting to MongoDB NoSQL Database, Connecting to Cassandra NoSQL Database.<br>**Few Interesting Differences:** Difference between Data Warehouse and Data Lake, Difference between RDBMS and HDFS, Difference between HDFS and HBase, Difference between Hadoop MapReduce and Spark, Difference between Pig and Hive **(Text Book 1)** |

| TEXTBOOKS | |
|---|---|
| **1.** | Big Data and Analytics by Seema Acharya, Subhashini Chellappan, Second Edition, Wiley India Pvt. Ltd., 2019 |
| **2.** | Learning Spark: Lightning-Fast Big Data Analysis by Andy Konwinski, Holden Karau, Matei Zaharia, Patrick Wendell, First Edition, O'Reilly, 2015 |

| REFERENCEBOOKS | |
|---|---|
| **1.** | Big Data Analytics, by Radha Shankarmani, M Vijayalakshmi, Second Edition, Wiley India Pvt. Ltd., 2016 |
| **2.** | Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley& sons, 2012. |
| **3.** | Hadoop: The Definitive Guide by Tom White, O'Reilly Media, Inc., 2009 |
| **4.** | Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications (WILEY Big Data Series)", John Wiley & Sons, 2014. |

| WEBRESOURCES | |
|---|---|
| **1.** | http://hadoop.apache.org/ |
| **2.** | https://nptel.ac.in/courses/106104189/ |
| **3.** | https://www.edx.org/course/big-data-fundamentals |
| **4.** | https://www.coursera.org/specializations/big-data |
| **5.** | https://www.wileyindia.com/big-data-and-analytics-2ed.html |

# NoSQL Databases

**Common to CSE(AI&ML), CSE(AI), CSE(DS)**

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | **20DS7T09** |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | Database Management Systems | **Internal Assessment Semester End Examination Total Marks** | 30<br>70<br>100 |

| **COURSEOBJECTIVES** | |
|---|---|
| **1** | Define, compare and use the four types of NoSQL Databases (Document-oriented, Key-Value Pairs, Column-oriented and Graph) |
| **2** | Demonstrate an understanding of the detailed architecture, define objects, load data, query data and performance tune Column-oriented NoSQL databases |
| **3** | Explain the detailed architecture, define objects, load data, query data and performance tune Document-oriented NoSQL databases |

| **COURSEOUTCOMES** | | **BTL** |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | |
| **CO1** | Discuss about Aggregate Data Models | K2 |
| **CO2** | Explain about Master-Slave Replication, Peer-to-Peer Replication | K2 |
| **CO3** | Describe the Structure of Data, Scaling, Suitable Use Cases | K2 |
| **CO4** | Make use of Complex Transactions Spanning Different Operations | K2 |
| **CO5** | Identify Routing, Dispatch and Location-Based Services | K2 |

**Contribution of Course Outcomes towards achievement of Program Outcomes(1–Low,2-Medium,3–High)**

| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO6 | PO7 | PO 8 | PO 9 | PO10 | PO1 1 | PO12 | PSO 1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 1 | 2 | - | - | - | - | - | | - | - | - | - | 3 | - |
| CO2 | 2 | 3 | 3 | 1 | | - | - | - | 1 | - | - | 1 | 1 | 1 | 2 |
| CO3 | 1 | 1 | 2 | 1 | 1 | - | - | - | 1 | - | - | 1 | 1 | 1 | 1 |
| CO4 | 3 | 3 | 1 | 3 | | - | - | - | 1 | - | - | 1 | 1 | 1 | 2 |
| CO5 | 3 | 3 | 1 | 3 | 1 | 1 | - | - | 1 | 1 | - | - | 1 | 1 | 2 |

| COURSE CONTENT | |
|---|---|
| UNIT I | **Introduction:** Why NoSQL, The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, A (Mostly) Standard Model, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL. **Aggregate Data Models:** Aggregates, Example of Relations and Aggregates, Consequences of Aggregate Orientation, Key-Value and Document Data Models, Column-Family Stores, Summarizing Aggregate-Oriented Databases. |
| UNIT II | **More Details on Data Models:** Relationships, Graph Databases, Schema less Databases, Materialized Views, Modelling for Data Access **Distribution Models:** Single Server, Shading, Master-Slave Replication, Peer-to-Peer Replication, Combining Shading and Replication. |
| UNIT III | **Key-Value Databases:** What Is a Key-Value Store, Key-Value Store Features, Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases, Storing Session Information, User Profiles, Preference, Shopping Cart Data, When Not to Use, Relationships among Data, Multi operation Transactions, Query by Data, Operations by Sets. |
| UNIT IV | **Document Databases:** What Is a Document Database?, Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics, Ecommerce Applications, When Not to Use, Complex Transactions Spanning Different Operations, Queries against Varying Aggregate Structure |
| UNIT V | **Graph Databases:** What Is a Graph Database?, Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Connected Data, Routing, Dispatch and Location-Based Services, Recommendation Engines, When Not to Use |

| | |
|---|---|
| **TEXTBOOKS** | |
| **1.** | Sadalage, P. & Fowler, No SQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Pearson Addision Wesley, 2012 |
| **2.** | Dan McCreary and Ann Kelly, "Making Sense of NoSQL: A guide for Managers and the Rest of us", 1st Edition, Manning Publication/Dreamtech Press, 2013. (ISBN-13: 978-9351192022) |
| **REFERENCEBOOKS** | |
| **1.** | Dan Sullivan, "NoSQL For Mere Mortals", 1st Edition, Pearson Education India, 2015. (ISBN13: 978-9332557338) |
| **2.** | Kristina Chodorow, "Mongodb: The Definitive Guide- Powerful and Scalable Data Storage", 2nd Edition, O'Reilly Publications, 2013. (ISBN-13: 978-9351102694) |
| **WEB RESOURCES** | |
| **1.** | https://www.guru99.com/nosql-tutorial.html\ |
| **2.** | https://www.w3resource.com/mongodb/nosql.php |

## Video Analytics

**CSE ( AI ML)**

**IV B Tech I Semester**

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 20AM7T07 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | Data Science through Python | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **The student will:** | |
| **1** | To know the fundamentals of digital image processing, image and video analysis |
| **2** | To understand the real time use of image and video analytics |
| **3** | To demonstrate real time image and video analytics applications and others |

| **COURSE OUTCOMES** | | |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | **Cognitive Level** |
| **CO1** | Describe the fundamental principles of image and video analysis and have an idea of their application | K2 |
| **CO2** | Apply various operations on Images | K2 |
| **CO3** | Perform various Image and Video Transformations | K3 |
| **CO4** | Enumerate various principles of Object detection and recognition | K2 |
| **CO5** | Apply image and video analysis in real world problems | K3 |

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

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

| COURSE CONTENT | |
|---|---|
| **UNIT-I** | **Digital image representation-** Visual Perception- Sampling and Quantization- Basic Relations between Pixels- Mathematical Tools Used in Digital Image Processing: Fundamental Operations –Vector and Matrix Operations- Image Transforms (DFT, DCT,DWT, Hadamard). |
| **UNIT-II** | **Fundamentals of spatial filtering**: Spatial correlation and convolution-smoothing, blurring-sharpening- edge detection - Basics of filtering in the frequency domain: smoothing- blurring-sharpening--Histograms and basic statistical models of image. |
| **UNIT-III** | **Colour models and Transformations** – Image and Video segmentation-Image and video demonising- Image and Video enhancement- Image and Video compression |
| **UNIT-IV** | Object detection and recognition in image and video-Texture models Image and Video 25 classification models- Object tracking in Video |
| **UNIT-V** | Applications and Case studies- Industrial- Retail- Transportation & Travel- Remote sensing-Video Analytics in WSN: IoT Video Analytics Architectures |

| TEXT BOOKS | |
|---|---|
| **1.** | R.C. Gonzalez and R.E. Woods.” Digital Image Processing”. 3rd Edition. Addison Wesley, 2007 |
| **2.** | Computer Vision: Algorithms and Applications, by Richard Szeliski. |
| **REFERENCE BOOKS** | |
| **1.** | Jean-Yves Dufour, “Intelligent Video Surveillance Systems”, Wiley, 2013 |
| **2.** | Caifeng Shan, Fatih Porikli, Tao Xiang, Shaogang Gong, “Video Analytics for Business Intelligence”, Springer, 2012 |
| **3.** | Asier Perallos, Unai Hernandez-Jayo, Enrique Onieva, Ignacio Julio García Zuazola, “Intelligent Transport Systems: Technologies and Applications”, Wiley, 2015 |
| **4.** | Multiple View Geometry in Computer Vision (2nd edition) by Richard hartley and Andrew Zisserman |
| **WEB RESOURCES:** | |
| **1** | https://developer.nvidia.com/blog/free-self-paced-online-course-for-intelligent-video-analytics- now-available/ |
| **2** | https://www.microfocus.com/en-us/products/ai-video-analytics/overview |
| **3** | https://www.udemy.com/course/machine-learning-on-videos-using-python/ |
| **4** | http://szeliski.org/Book/ |

# PRAGATI ENGINEERING COLLEGE
## (Autonomous)
## B.Tech
## Computer Science and Engineering (Artificial Intelligence & Machine Learning)

**R-20**

## Professional Elective – V
### Recommender Systems
**CSE ( AI ML)**
**IV B Tech I Semester**

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 20AM7T08 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | Machine Learning | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **The student will:** | |
| **1** | To develop state-of-the-art recommender systems that automates a variety of choice-makingstrategies with the goal of providing affordable, personal, and high-quality recommendations. |

| **COURSE OUTCOMES** | | |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | **Cognitive Level** |
| **CO1** | Understand the basic concepts of recommender systems. | K1 |
| **CO2** | Carry out performance evaluation of recommender systems based on variousmetrics. | K2 |
| **CO3** | Implement machine-learning and data-mining algorithms in recommender systems data sets. | K3 |
| **CO4** | Design and implement a simple recommender system | K4 |
| **CO5** | Implement various recommender systems like Paradigms etc.. | K5 |

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

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

| COURSE CONTENT | |
|---|---|
| **UNIT-I** | An Introduction to Recommender Systems: Goals of Recommender Systems, Basic Models of Recommender Systems, Collaborative Filtering Models, Content-Based Recommender Systems, Knowledge-Based Recommender Systems, Domain-Specific Challenges in Recommender Systems, Advanced Topics and Applications. |
| **UNIT-II** | Neighborhood-Based Collaborative Filtering: Key Properties of Ratings Matrices, Predicting Ratings with Neighborhood-Based Methods, Clustering and Neighborhood-Based Methods, Dimensionality Reduction and Neighborhood Methods, A Regression Modeling View of Neighborhood Methods, Graph Models for Neighborhood-Based Methods |
| **UNIT-III** | Model-Based Collaborative Filtering: Decision and Regression Trees, Rule-Based Collaborative Filtering, Naïve Bayes Collaborative Filtering, Latent Factor Models, Integrating Factorization and Neighborhood Models |
| **UNIT-IV** | Content-Based Recommender Systems: Basic Components of Content-Based Systems, Preprocessing and Feature Extraction, Learning User Profiles and Filtering, Content-Based Versus Collaborative Recommendations<br>Knowledge-Based Recommender Systems: Constraint-Based Recommender Systems, Case-BasedRecommenders, Persistent Personalization in Knowledge-Based Systems. |
| **UNIT-V** | Evaluating Recommender Systems: Evaluation Paradigms, General Goals of Evaluation Design, Design Issues in Offline Recommender Evaluation, Accuracy Metrics in Offline Evaluation, Limitations of Evaluation Measures.. |

| TEXT BOOKS | |
|---|---|
| **1.** | Charu .C. Aggarwal, Recommender Systems: The Textbook, Springer, 2016. |
| **2.** | Jannach D., Zanker M. and FelFering A., Recommender Systems: An Introduction, Cambridge University Press, (2011), 1st ed. |
| **REFERENCE BOOKS** | |
| **1.** | Ricci F., Rokach L., Shapira D., Kantor B.P., Recommender Systems Handbook,Springer(2011), 1st ed. |
| **2.** | Manouselis N., Drachsler H., Verbert K., Duval E., Recommender Systems For Learning,Springer (2013), 1st edition. |
| **3.** | J. Leskovec, A. Rajaraman and J. Ullman, Mining of massive datasets, 2nd Ed., Cambridge,2012 |
| **WEB RESOURCES:** | |
| **1.** | Swayam NPTEL: https://nptel.ac.in/courses/106105152w |

# PRAGATI ENGINEERING COLLEGE
## (Autonomous)
### B.Tech
### Computer Science and Engineering (Artificial Intelligence & Machine Learning)

**R-20**

## AI Chatbots
**Common to CSE (AI), CSE (AI&ML), CSE (DS)**

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 20AI7T07 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **The student will:** | |
| **1** | Learn how artificial intelligence powers chatbots, get an overview of the bot ecosystem and bot anatomy, and study different types of bots and use cases. |
| **2** | Identify best practices for defining a chatbot use case, and use a rapid prototyping framework to develop a use case for a personalized chatbot. |

| **COURSE OUTCOMES** | | |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | **Cognitive Level** |
| **CO1** | Develop an in-depth understanding of conversation design, including on Boarding | K3 |
| **CO2** | Develop an in-depth understanding of conversation design, including on flows, utterances | K3 |
| **CO3** | Develop an in-depth understanding of conversation design, including on entities, and personality. | K3 |
| **CO4** | Design, build, test, and iterate a fully-functional, interactive chatbot using a commercial platform. | K3 |
| **CO5** | Deploy the finished chatbot for public use and interaction. | K4 |

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

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

| COURSE CONTENT | |
|---|---|
| **UNIT-I** | **Introduction:** Benefits from Chatbots for a Business, A Customer-Centric Approach in Financial Services, Chatbots in the Insurance Industry, Conversational Chatbot Landscape, Identifying the Sources of Data: Chatbot Conversations, Training Chatbots for Conversations, Personal Data in Chatbots, Introduction to the General Data Protection Regulation (GDPR) |
| **UNIT-II** | **Chatbot Development Essentials:** Customer Service-Centric Chatbots, Chatbot Development Approaches, Rules-Based Approach, AI-Based Approach, Conversational Flow, Key Terms in Chatbots, Utterance, Intent, Entity, Channel, Human Takeover, Use Case: 24x7 Insurance Agent |
| **UNIT-III** | **Building a Chatbot Solution:** Business Considerations, Chatbots Vs Apps, Growth of Messenger Applications, Direct Contact Vs Chat, Business Benefits of Chatbots, Success Metrics, Customer Satisfaction Index, Completion Rate, Bounce Rate, Managing Risks in Chatbots Service, Generic Solution Architecture for Private Chatbots |
| **UNIT-IV** | **Natural Language Processing, Understanding, and Generation:** Chatbot Architecture, Popular Open Source NLP and NLU Tools, Natural Language Processing, Natural Language Understanding, Natural Language Generation, Applications. |
| **UNIT-V** | **Introduction to Microsoft Bot, RASA, and Google Dialog flow:** Microsoft Bot Framework, Introduction to QnA Maker, Introduction to LUIS, Introduction to RASA, RASA Core, RASA NLU, Introduction to Dialog flow<br>Chatbot Integration Mechanism: Integration with Third-Party APIs, Connecting to an Enterprise Data Store, Integration Module |

| TEXT BOOKS | |
|---|---|
| **1.** | Abhishek Singh, Karthik Ramasubramanian, Shrey Shivam, “Building an Enterprise Chatbot: Work with Protected Enterprise Data Using Open Source Frameworks”, ISBN 978-1-4842-5034-1, Apress,2019 |
| **2.** | . Janarthanam and Srini, Hands-on chatbots and conversational UI development: Build chatbots and voice user interfaces with C (1 ed.), Packt Publishing Ltd, 2017. ISBN 978-1788294669. |
| **REFERENCE BOOKS** | |
| **1.** | Galitsky, Boris., Developing Enterprise Chatbots (1 ed.), Springer International Publishing, 2019. ISBN 978-303004298 |
| **2.** | . Kelly III, John E. and Steve Hamm, Smart machines: IBM's Watson and the era of cognitive computing (1 ed.), Columbia University Press, 2013. ISBN 978- 0231168564. |
| **3.** | Abhishek Singh, Karthik Ramasubramanian and Shrey Shivam, Building an Enterprise Chatbot (1 ed.), Springer, 2019. ISBN 978-1484250334 |
| **WEB RESOURCES:** | |
| **1** | Introduction to Chatbot \| Artificial Intelligence Chatbot Tutorial (mygreatlearning.com) |

# PRAGATI ENGINEERING COLLEGE
## (Autonomous)
## B.Tech
## Computer Science and Engineering (Artificial Intelligence & Machine Learning)

**R-20**

# Object Oriented Analysis and Design

**CSE, CSE(AI), CSE(AI&ML)**

| | | | |
|---|---|---|---|
| **Course Category** | Professional Elective | **Course Code** | 20CS6T16 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | Become familiar with all phases of OOAD |
| **2** | Master the main features of the UML. |
| **3** | Master the main concepts of Object Technologies and how to apply them at work and develop the ability to analyze and solve challenging problem in various domains |
| **4** | Learn the Object design Principles and understand how to apply them towards Implementation |

| **COURSE OUTCOMES** | | **BTL** |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | |
| **CO1** | Analyze the nature of complex system and its solutions | K4 |
| **CO2** | Illustrate & relate the conceptual model of the UML, identify & design the classes and relationships | K2 |
| **CO3** | Analyze &Design Class and Object Diagrams that represent Static Aspects of a Software System and apply basic and Advanced Structural Modeling Concepts for designing real time applications | K4 |
| **CO4** | Analyze & Design behavioral aspects of a Software System using Use Case, Interaction and Activity Diagrams | K4 |
| **CO5** | Analyze & Apply techniques of State Chart Diagrams and Implementation Diagrams to model behavioral aspects and Runtime environment of Software Systems | K4 |

**Note:** K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

| Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 3 | 2 | 2 | 2 | - | - | - | - | - | - | - | 3 | 3 | 3 |
| CO2 | 3 | 3 | 2 | 2 | 2 | - | - | - | - | - | - | - | 3 | 3 | 3 |
| CO3 | 3 | 3 | 2 | 2 | 2 | - | - | - | - | - | - | - | 3 | 3 | 3 |
| CO4 | 3 | 3 | 2 | 2 | 2 | - | - | - | - | - | - | - | 3 | 3 | 3 |
| CO5 | 3 | 3 | 2 | 2 | 2 | - | - | - | - | - | - | - | 3 | 3 | 3 |

| COURSE CONTENT | |
|---|---|
| UNIT I | **Introduction:** The Structure of Complex systems, The Inherent Complexity of Software, Attributes of Complex System, Organized and Disorganized Complexity, Bringing Order to Chaos, Designing Complex Systems. **Case Study:** System Architecture: Satellite-Based Navigation |
| UNIT II | **Introduction to UML:** Importance of modeling, principles of modeling, object oriented modeling, conceptual model of the UML, Architecture, and Software Development Life Cycle. **Basic Structural Modeling:** Classes, Relationships, common Mechanisms, and diagrams. **Case Study:** Control System: Traffic Management. |
| UNIT III | **Class & Object Diagrams:** Terms, concepts, modeling techniques for Class & Object Diagrams. **Advanced Structural Modeling:** Advanced classes, advanced relationships, Interfaces, Types and Roles, Packages. **Case Study:** AI: Cryptanalysis. |
| UNIT IV | **Basic Behavioral Modeling-I:** Interactions, Interaction diagrams Use cases, Use case Diagrams, Activity Diagrams. **Case Study:** Web Application: Vacation Tracking System |
| UNIT V | **Advanced Behavioral Modeling:** Events and signals, state machines, processes and Threads, time and space, state chart diagrams. **Architectural Modeling:** Component, Deployment, Component diagrams and Deployment diagrams<br>**Case Study:** Weather Forecasting |

| TEXT BOOKS | |
|---|---|
| 1. | Grady BOOCH, Robert A. Maksimchuk, Michael W. ENGLE, Bobbi J. Young, Jim Conallen, Kellia Houston , -Object- Oriented Analysis and Design with Applications|, 3rd edition, 2022, PEARSON. |
| 2. | Grady Booch, James Rumbaugh, Ivar Jacobson: The Unified Modeling Language User Guide, Pearson Education. |
| **REFERENCE BOOKS** | |
| 1. | Meilir Page-Jones: Fundamentals of Object Oriented Design in UML, Pearson Education. |
| 2. | Pascal Roques: Modeling Software Systems Using UML2, WILEY- Dreamtech India Pvt. Ltd. |

| | |
|---|---|
| **3.** | Atul Kahate: Object Oriented Analysis & Design, The McGraw-Hill Companies. |
| **4.** | Appling UML and Patterns: An introduction to Object – Oriented Analysis and Design and Unified Process, Craig Larman, Pearson Education. |
| **WEB RESOURCES** | |
| **1.** | http://www.digimat.in/nptel/courses/video/106105153/L51.html |

# PRAGATI ENGINEERING COLLEGE
## (Autonomous)
## B.Tech
## Computer Science and Engineering (Artificial Intelligence & Machine Learning)

**R-20**

**Semantic Web**

**CSE ( AI ML)**

**IV B Tech I Semester**

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 20AI7T09 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | Computer Networks | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **The student will:** | |
| **1** | To learn Web Intelligence. |
| **2** | To learn Knowledge Representation for the Semantic Web. |
| **3** | To learn Ontology Engineering. |
| **4** | To learn Semantic Web Applications, Services and Technology. |
| **5** | To learn Social Network Analysis and semantic web. |

| **COURSE OUTCOMES** | | |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | **Cognitive Level** |
| **CO1** | Demonstrate social network analysis and measures. | K1 |
| **CO2** | Analyze random graph models and navigate social networks data. | K2 |
| **CO3** | Apply the network topology and Visualization tools. | K3 |
| **CO4** | Analyze the experiment with small world models and clustering models. | K4 |
| **CO5** | Compare the application driven virtual communities from social networkStructure. | K5 |

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

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

| COURSE CONTENT | |
|---|---|
| **UNIT-I** | Web Intelligence: Thinking and Intelligent Web Applications, The Information Age ,The World Wide Web, Limitations of Today's Web, The Next Generation Web, Machine Intelligence, Artificial Intelligence, Ontology, Inference engines, Software Agents, Berners-Lee www, Semantic Road Map, Logic on the semantic Web. |
| **UNIT-II** | Knowledge Representation for the Semantic Web: Ontologies and their role in the semantic web, Ontologies Languages for the Semantic Web –Resource Description Framework(RDF) / RDF Schema, Ontology Web Language(OWL), UML, XML/XML Schema. |
| **UNIT-III** | **Ontology Engineering**: Ontology Engineering, Constructing Ontology, Ontology Development Tools, Ontology Methods, Ontology Sharing and Merging, Ontology Libraries and Ontology Mapping, Logic, Rule and Inference Engines |
| **UNIT-IV** | Semantic Web Applications, Services and Technology: Semantic Web applications and services, Semantic Search, e-learning, Semantic Bioinformatics, Knowledge Base ,XML Based Web Services, Creating an OWL-S Ontology for Web Services, Semantic Search Technology, Web Search Agents and Semantic Methods, |
| **UNIT-V** | Social Network Analysis and semantic web: What is social Networks analysis, development of the social networks analysis, Electronic Sources for Network Analysis – Electronic Discussion networks, Blogs and Online Communities, Web Based Networks, Building Semantic Web Applications with social network features. |

| TEXT BOOKS | |
|---|---|
| **1.** | Thinking on the Web – Berners Lee, Godel and Turing, Wiley inter science, 2008. |
| **2.** | Social Networks and the Semantic Web, Peter Mika, Springer, 2007. |
| **Reference Books** | |
| **1.** | Semantic Web Technologies, Trends and Research in Ontology Based Systems, J. Davies, R.Studer, P. Warren, John Wiley & Sons. |
| **2.** | Semantic Web and Semantic Web Services -Liyang Lu Chapman and Hall/CRCPublishers,(Taylor & Francis Group). |
| **3.** | Information sharing on the semantic Web – Heiner Stucken schmidt; Frank Van Harmelen, Springer Publications. |
| | |
| **4.** | Programming the Semantic Web, T. Segaran, C. Evans, J. Taylor, O'Reilly, SPD. |
| **WEB RESOURCES:** | |
| **1** | Swayam NPTEL: https://onlinecourses.nptel.ac.in/noc19_cs56/preview |

# PRAGATI ENGINEERING COLLEGE
## (Autonomous)
### B.Tech
### Computer Science and Engineering (Artificial Intelligence & Machine Learning)

**R-20**

## Open Elective-III
## Highway Engineering

| | | | |
|---|---|---|---|
| **Course Category** | Professional course | **Course Code** | 20CE7T11 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | ------ | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To introduce the students with the principles and practice of transportation engineering which focuses on Highway Engineering. |
| **2** | Ability to mathematically develop and interpret design standards for horizontal and vertical geometry and super elevation |
| **3** | To provide basic knowledge on materials used in pavement construction. |
| **4** | To enable the students to have a strong analytical and practical knowledge of Planning, Designing of Pavements. |
| **5** | To provide basic knowledge in traffic engineering, and transportation planning. |

| **COURSE OUTCOMES** | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Plan highway network for a given area. |
| **CO2** | Design the Highway geometrics based on highway alignment. |
| **CO3** | Characterize the pavement materials like aggregates, Bituminous materials &construction. |
| **CO4** | Judge suitability of pavement materials and design flexible and rigid pavements. |
| **CO5** | Design Intersections and prepare traffic management plans. |

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

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

| COURSE CONTENT | |
|---|---|
| **UNIT I** | **Highway Planning and Alignment:** Highway development in India; Classification of Roads; Road Network Patterns; Necessity for Highway Planning; Different Road Development Plans – First, second, third road development plans, road development vision 2021, Rural Road Development Plan – Vision 2025; Planning Surveys; Highway Alignment- Factors affecting Alignment- Engineering Surveys – Drawings and Reports. |
| **UNIT II** | **Highway Geometric Design:** Importance of Geometric Design- Design controls and Criteria- Highway Cross Section Elements- Sight Distance Elements-Stopping sight Distance, Overtaking Sight Distance and Intermediate Sight Distance- Design of Horizontal Alignment- Design of Super elevation and Extra widening- Design of Transition Curves-Design of Vertical alignment- Gradients- Vertical curves. |
| **UNIT III** | **Highway Materials:** Sub-grade soil: classification –Group Index – Subgrade soil strength – California Bearing Ratio – Modulus of Subgrade Reaction. Stone aggregates: Desirable properties – Tests for Road Aggregates – Bituminous Materials: Types – Desirable properties -Tests on Bitumen . |
| **UNIT IV** | **Design of Pavements:** Types of pavements; Functions and requirements of different components of pavements; Design Factors<br>**Flexible Pavements:** Design factors – Flexible Pavement Design Methods – CBR method – IRC method – Burmister method – Mechanistic method – IRC Method for Low volume Flexible pavements.<br>**Rigid Pavements:** Design Considerations – wheel load stresses – Temperature stresses – Frictional stresses – Combination of stresses – Design of slabs – Design of Joints – IRC method – Rigid pavements for low volume roads – Continuously Reinforced Cement Concrete Pavements – Roller Compacted Concrete Pavements. |
| **UNIT V** | **Traffic Engineering:** Basic Parameters of Traffic-Volume, Speed and Density- Traffic Volume Studies; Speed studies –spot speed and speed & delay studies; Parking Studies; Road Accidents- Causes and Preventive measures - Condition Diagram and Collision Diagrams; PCU Factors, Capacity of Highways – Factors Affecting; LOS Concepts; Road Traffic Signs; Road markings; Types of Intersections; At-Grade Intersections – Design of Plain, Flared, Rotary and Channelized Intersections; Design of Traffic Signals –Webster Method –IRC method. |

| TEXT BOOKS | |
|---|---|
| **1.** | Highway Engineering' by Paul H. Wright and Karen K Dixon, Wiley Student Edition, Wiley India (P) Ltd., New Delhi. |
| **2.** | Highway Engineering' by Khanna S.K., Justo C.E.G and Veeraragavan A, Nem Chand Bros, Roorkee. |
| **REFERENCE BOOKS** | |
| **1.** | Transportation Engineering and Planning' by Papacostas C.S. and PD Prevedouros, Prentice Hall of India Pvt. Ltd, New Delhi. |
| **2.** | 'Highway Engineering' by Srinivasa Kumar R, Universities Press, Hyderabad |
| **WEB RESOURCES** | |
| **1.** | https://nptel.ac.in/downloads/105101087/ |

# Battery Management Systems and Charging Stations

| | | | |
|---|---|---|---|
| **Course Category** | Open Elective | **Course Code** | 20EE7T29 |
| **Course Type** | Theory | **L-T-P-C** | **3-0-0-3** |
| **Prerequisites** | **NIL** | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | **30**<br>**70**<br>**100** |

| **COURSE OBJECTIVES** | |
|---|---|
| 1 | To discuss about the different types of batteries. |
| 2 | To describe about the battery characteristic & parameters. |
| 3 | To apply the concepts of battery management system and design the battery pack. |
| 4 | To explain about the battery testing, disposal and recycling. |
| 5 | To describe different methods of EV charging |

| **COURSE OUTCOMES** | | |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | **Cognitive Level** |
| CO1 | Discuss about the different types of batteries. | K2 |
| CO2 | Describe about the battery characteristic & parameters. | K2 |
| CO3 | Apply the concepts of battery management system and design the battery pack. | K3 |
| CO4 | Explain about the battery testing, disposal and recycling. | K2 |
| CO5 | Describe different methods of EV charging | K2 |
| K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create | | |

| **Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
| **CO1** | 2 | - | - | - | - | - | - | - | - | - | - | 1 | 1 | 1 | - |
| **CO2** | 2 | - | - | - | - | - | - | - | - | - | - | 1 | 1 | 1 | - |
| **CO3** | 2 | 1 | 1 | - | 1 | 1 | 1 | - | - | - | - | 1 | 1 | 1 | - |
| **CO4** | 2 | - | - | - | 1 | 1 | 1 | - | - | - | - | 1 | 1 | 1 | - |
| **CO5** | 2 | - | - | - | - | - | - | - | - | - | - | 1 | 1 | 1 | - |

| COURSE CONTENT | |
|---|---|
| **UNIT 1** | **Batteries**<br>Lead Acid Battery, Nickel based batteries, Sodium based batteries, Lithium based batteries – Li-ion & Li-poly, Metal Air Battery, Zinc Chloride battery; Ultra capacitors; Flywheel Energy Storage System; Hydraulic Energy Storage System; Comparison of different Energy Storage System Suggested reading: Study of different types of batteries |
| **UNIT 2** | **Battery Characteristics & Parameters**<br>Cells and Batteries- conversion of chemical energy to electrical energy- Battery Specifications: Variables to characterize battery operating conditions and Specifications to characterize battery nominal and maximum characteristics; Efficiency of batteries; Electrical parameters Heat generation- Battery design Performance criteria for Electric vehicles batteries- Vehicle propulsion factors- Power and energy requirements of batteries- Meeting battery performance criteria- setting new targets for battery performance. |
| **UNIT 3** | **Battery Pack and Battery Management System**<br>Selection of battery for EVs & HEVs, Traction Battery Pack design, Requirement of Battery Monitoring, Battery State of Charge Estimation methods, Battery Cell equalization problem, thermal control, protection interface, SOC Estimation, Energy & Power estimation, Battery thermal management system, Battery Management System: Definition, Parts: Power Module, Battery, DC/DC Converter, load, communication channel, Battery Pack Safety, Battery Standards & Tests |
| **UNIT 4** | **Battery Testing, Disposal & Recycling**<br>Chemical & structure material properties for cell safety and battery design, battery testing, limitations for transport and storage of cells and batteries, Recycling, disposal and second use of batteries. Battery Leakage: gas generation in batteries, leakage path, leakage rates. Ruptures: Mechanical stress and pressure tolerance of cells, safety vents, Explosions: Causes of battery explosions, explosive process, Thermal Runway: High discharge rates, Short circuits, charging and discharging. Environment and Human Health impact assessments of batteries, General recycling issues and drivers, methods of recycling of EV batteries. |
| **UNIT 5** | **Charging Stations**<br>Electric Vehicle Technology and Charging Equipment‘s, Basic charging Block Diagram of Charger, Difference between Slow charger and fast charger, Slow charger design rating, Fast charger design rating, AC charging and DC charging, Inboard and off board charger specification, Type of Mode of charger Mode -2, Mode-3 and Mode-4, EVSE associated charge times calculation. |

| | |
|---|---|
| **TEXT BOOKS** | |
| 1 | Guangjin Zhao, –Reuse and Recycling of Lithium-Ion Power Batteries‖, John Wiley & Sons. 2017. (ISBN: 978-1-1193-2185-9) |
| 2 | Arno Kwade, Jan Diekmann, ―Recycling of Lithium-Ion Batteries: The LithoRec Way‖, Springer, 2018. (ISBN: 978-3-319-70571-2) |
| **REFERENCE BOOKS** | |
| 1 | Ibrahim Dinçer, Halil S. Hamut and Nader Javani, –Thermal Management of Electric Vehicle Battery Systems‖, John Wiley& Sons Ltd., 2016. |
| 2 | Chris Mi, Abul Masrur & David Wenzhong Gao, –Hybrid electric Vehicle- Principles & Applications with Practical Properties‖, Wiley, 2011. |
| 3 | G. Pistoia, J.P. Wiaux, S.P. Wolsky, ―Used Battery Collection and Recycling‖, Elsevier, 2001. (ISBN: 0-444-50562-8)‖ |
| 4 | T R Crompton, ―Battery Reference Book-3 rd Edition‖, Newnes- Reed Educational and Professional Publishing Ltd., 2000. |
| 5 | James Larminie, John Lowry, ―Electric Vehicle Technology Explained‖, John Wiley & Sons Ltd, 2003. |
| **WEB RESOURCES (Suggested)** | |
| 1 | https://nptel.ac.in/courses/108106170 |
| 2 | https://www.youtube.com/watch?v=omnQN5Z5vsA |

# Industrial Electronics

| | | | |
|---|---|---|---|
| **Course Category** | Open Elective | **Course Code** | 20EC7T40 |
| **Course Type** | Theory | **L-T-P-C** | **3-0-0-3** |
| **Prerequisites** | Basic Electrical and Electronics Engineering | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **Student will learn** | |
| **1** | The building block for differential amplifier and operational amplifier using DC amplifiers and applications of OP-AMP. |
| **2** | Voltage Regulator ,Types of Voltage Regulators and their working and use of a different voltage regulators for real time applications |
| **3** | The characteristics and operation of SCR and Thyristor and techniques to turn Off a Thyristor |
| **4** | The operation and applications of important switching devices such as DIAC and TRIAC much used in power electronics |
| **5** | The different electronic devices such as Electronic timers and Electronic DC Motor and Control, Electric Welding methods, high frequency heating ,ultrasonic generation required for industrial applications |

| **COURSE OUTCOMES** | | |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | **Cognitive Level** |
| **CO1** | Understand the concept of DC amplifiers. | K2 |
| **CO2** | Analyze and design different voltage regulators for real time applications | K2 |
| **CO3** | Describe the basis of SCR and Thyristor | K2 |
| **CO4** | Determine the performance of DIAC and TRIAC | K2 |
| **CO5** | Develop real time application using electronics | K2 |

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

**Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)**

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

| COURSE CONTENT | |
|---|---|
| UNIT I | DC Amplifiers: Need for DC amplifiers, DC amplifiers - Drift, Causes, Darlington Emitter Follower, Cascode amplifier, Stabilization, Differential amplifiers - Chopper stabilization, Operational Amplifiers, Ideal specifications of Operational Amplifiers, Instrumentation Amplifiers. |
| UNIT II | Regulated Power Supplies: Block diagram, Principle of voltage regulation, Series and Shunttype Linear Voltage Regulators, Protection Techniques - Short Circuit, Over voltage and Thermal Protection. Switched Mode & IC Regulators: Switched Mode voltage regulator, Comparison of Linear and Switched Mode Voltage Regulators,Servo Voltage Stabilizer, monolithic voltage regulators Fixed and Adjustable IC<br>Voltage regulators, 3-terminal Voltage regulators - Current boosting |
| UNIT III | **SCR and Thyristor:** Principles of operation and characteristics of SCR, Triggering of Thyristors, Commutation Techniques of Thyristors - Classes A, B, C, D, E and F, Ratings of SCR. |
| UNIT IV | **Applications of SCR in Power Control:** Static circuit breaker, Protection of SCR, Inverters - Classification, Single Phase inverters, Converters –single phase Half waveand Full wave.<br>DIAC, TRIAC and Thyristor Applications: Chopper circuits – Principle,methods and Configurations, DIAC AND TRIAC, TRIACS – Triggering modes, Firing Circuits, Commutation |
| UNIT V | **Industrial Applications -I:**<br>Industrial timers -Classification, types, Electronic Timers – Classification, RC and Digital Timers, Time base Generators. Electric Welding Classification, types and methods of Resistance and ARC wielding, Electronic DC Motor Control.<br>**Industrial Applications –II**: High Frequency heating – principle, merits, applications, High frequency Source for Induction heating. Dielectric Heating – principle, material properties, Electrodes and their Coupling to RF generator, Thermal losses and Applications. Ultrasonics – Generation and Applications |

| TEXT BOOKS | |
|---|---|
| 1. | Industrial and Power Electronics – G. K. Mithal and Maneesha Gupta, Khanna Publishers, 19th Ed., 2003. |
| 2. | Integrated Electronics – J. Millman and C.C Halkias, McGraw Hill, 1972 |
| **REFERENCE BOOKS** | |
| 1. | Electronic Devices and circuits – Theodore. H. Bogart, Pearson Education, 6th Edition, 2003 |
| 2. | Thyristors and applications – M. Rammurthy, East-West Press, 1977. |
| **WEB RESOURCES** | |
| 1. | https://nptel.ac.in/courses/108102145 |

# Organizational behavior

| | | | |
|---|---|---|---|
| **Course Category** | Open Elective | **Course Code** | 20HM7T09 |
| **Course Type** | Theory | **Lecture-Tutorial-Practice** | 3 -0 -0-3 |
| **Prerequisites** | | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **Course Outcomes** | | **Blooms Taxonomy Level** |
|---|---|---|
| **On successful completion of the course, the student will be able to** | | |
| **CO 1** | Understand the meaning and importance of Organizational Behavior to start and survive in corporate environment. | K2 |
| **CO 2** | Demonstrate how the perception can integrate in human behaviour , attitudes and values. | K2 |
| **CO 3** | Understand the importance of Groups and Teams in organizations for better Decision making. | K2 |
| **CO 4** | Understand the need for change and its importance in organizations. | K2 |
| **CO 5** | Understand the culture of organizations and to apply techniques in dealing with stress in organizations. | K4 |

**Contribution of Course Outcomes towards achievement of Program**

Outcomes: 1 – Low, 2 - Medium, 3 – High

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

| COURSE CONTENT | |
|---|---|
| **UNIT I** | Introduction to Organizational Behaviour<br>Concept-Nature and scope-Importance of Organizational Behaviour-Key elements of Organizational Behaviour-Role of managers in Organizational Behaviour-Approaches to Organizational Behaviour-Perspectives of Human Behaviour-Challenges and Opportunities for Organizational Behaviour. |
| **UNIT II** | Perceptual Management<br>Nature-Process of Perception- Organization and Interpretation-Influencing factors-Importance of Perception in OB - Perceptual Errors- Attitudes and Values –Changes and Behaviour Modification Techniques-Impression Management |
| **UNIT III** | Introduction to Groups and Teams<br>Meaning –Importance of Groups - Foundations of Group Behaviour –Reasons for Group formation-Group and Team-Types of Groups-Stages of Group development – Meaning and Importance of Teams- Factors affecting Group and Team performance-<br>Types of teams-Creating an effective Team. |
| **UNIT IV** | Organization Change and Development<br>Definition and Meaning - Need for change-Forces for changes in Organization-Types of change-Organizational Resistance-Strategies overcome Resistance-Process of change-Meaning and Definition of Organization Development-OD interventions. |
| **UNIT V** | Organizational Culture and Organizational Stress<br>Organizational culture: Meaning and Nature of Organizational Culture-Functions-Types-Creating and maintain Organizational Culture-Managing Cultural Diversity. Organizational Stress: Definition and Meaning-Sources of stress-Impact of stress on organizations-Stress Management Techniques. |

| TEXT BOOKS | |
|---|---|
| **1.** | K.Aswathappa: -Organizational Behaviour-Text, Cases and Games\|, Himalaya Publishing House, New Delhi, 2017. |
| **2.** | Stephen P. Robbins, Timothy, A. Judge: -Essentials of Organizational Behaviour\| Pearson,2017 |
| **3.** | Pareek Udai, Sushma Khanna: ―Understanding Organizational Behaviour‖, Oxford University Press, New Delhi, 2016 |
| **REFERENCE BOOKS** | |
| **1.** | Luthans, Fred: Organizational Behaviour 10/e, McGraw-Hill, 2015 |
| **2.** | Steven L McShane, Mary Ann Von Glinow, Radha R Sharma: -Organizational Behavior\|, Tata McGraw Hill Education, New Delhi, 2017. |
| **3.** | Jerald Greenberg and Robert A Baron: -Behavior in Organizations\|, PHI Learning Private Limited, New Delhi, 2013. |
| **4.** | Jai B.P.Sinha: -Culture and Organizational Behavior\|, Sage Publication India Private Limited, New Delhi, 2009. |
| **5.** | New strom W. John& Davis Keith, Organisational Behaviour--Human Behaviour at Work, 12/e, TMH, New Delhi, 2009. |

| WEB RESOURCES | |
|---|---|
| 1. | https://www.diversityresources.com/cultural-diversity-workplace/ |
| 2. | https://www.chanty.com/blog/problem-solving-techniques/ |
| 3. | https://www.simplypsychology.org/perspective.html#:~:text=The%20five%20major%20perspectives%20in,%2C%20behavioral%2C%20cognitive%20and%20humanistic |
| 4. | https://theintactone.com/2019/06/18/mpob-u3-topic-6-perception-process-and-errors |

# Open Elective-IV

## Water Resourse Engineering

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 20CE7T18 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | Hydraulics and Hydraulic Machinery | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To introduce hydrologic cycle and its relevance to Civil engineering. |
| **2** | Make the students understand physical processes in hydrology and, components of the hydrologic cycle. |
| **3** | Appreciate concepts and theory of physical processes and interactions. |
| **4** | Learn measurement and estimation of the components hydrologic cycle. |
| **5** | Provide an overview and understanding of Unit Hydrograph theory and its analysis. |
| **6** | Understand flood frequency analysis, design flood, flood routing. |
| **7** | Appreciate the concepts of groundwater movement and well hydraulics |
| **8** | Learn overview of flood routing and its effects. |
| **9** | Has to be understood and identify the flood occurring areas nearby. |

| **COURSE OUTCOMES** | |
|---|---|
| **Upon successful completion of the course, the student will be able to:** | |
| **CO1** | Explain the theories and principles governing the hydrologic processes and list out the forms of precipitation in real conditions. |
| **CO2** | Apply key concepts to several practical areas of engineering hydrology and related design aspects. |
| **CO3** | Design major hydrologic components for a need-based structures. |
| **CO4** | Estimate flood magnitude and carry out flood routing. |
| **CO5** | Demonstrate the recuperation test process in open wells. |

| Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | 3 | 2 | 2 | 2 | 2 | 2 | -- | -- | -- | -- | 1 | -- | 1 | -- | 2 |
| CO2 | 3 | 2 | 2 | 2 | 2 | 2 | -- | -- | -- | -- | 1 | -- | 1 | -- | 2 |
| CO3 | 3 | 2 | 2 | 2 | 2 | 2 | -- | -- | -- | -- | 1 | -- | 1 | -- | 2 |
| CO4 | 3 | 2 | 2 | 2 | 2 | 2 | -- | -- | -- | -- | 1 | -- | 1 | -- | 2 |
| CO5 | 3 | 2 | 2 | 2 | 1 | 2 | -- | -- | -- | -- | 1 | -- | 1 | -- | 2 |

| COURSE CONTENT | |
|---|---|
| UNIT I | INTRODUCTION: Engineering hydrology and its applications, Hydrologic cycle, hydrological data-sources of data. Precipitation: Types and forms, measurement, rain gauge network, presentation of rainfall data, average rainfall, continuity and consistency of rainfall data, Frequency of point rainfall, Rain fall data in India. Intensity-Duration-Frequency (IDF) curves, Depth-Area Duration (DAD) curves, Probable Maximum Precipitation (PMP), design storm, problems on average rainfall on towns |
| UNIT II | ABSTRACTIONS FROM PRECIPITATION: Introduction, Initial abstractions. EVAPORATION: Factors affecting, measurement, reduction, Analytical methods ofEvaporation estimation. EVAPOTRANSPIRATION: Factors affecting, measurement, control, Potential Evapotranspiration over India. INFILTRATION: Factors affecting, Infiltration capacity curve, measurement, Infiltration Indices. Problems on ϕ-Index and W-Index. |
| UNIT III | RUNOFF: Catchment characteristics, Factors affecting runoff, components, computation- empirical formulae, tables and curves, stream gauging, rating curve, flow mass curve and flow duration curve. HYDROGRAPH ANALYSIS: Components of hydrograph, separation of base flow, effectiverainfall hyetograph and direct runoff hydrograph, unit hydrograph, assumptions, derivation of unit hydrograph, unit hydrographs of different durations, principle of superposition and S- hydrograph methods, limitations and applications of unit hydrograph, synthetic unit hydrograph. Problems on unit hydrograph. |
| UNIT IV | FLOODS: Causes and effects, frequency analysis - Gumbel's and Log-Pearson type III distribution methods, Standard Project Flood (SPF) and Probable Maximum Flood (MPF), flood control methods and management, Design flood, Design storm. FLOOD ROUTING: Hydrologic storage routing, channel and reservoir routing- Muskingum and Puls methods of routing, flood control in India. ADVANCED TOPICS IN HYDROLOGY: Rainfall-Runoff Modelling, Instantaneous Unit Hydrograph (IUH) - Conceptual models - Clark and Nash models, general hydrological models-Chow - Kulandaiswamy model. |
| UNIT V | GROUNDWATER: Occurrence, types of aquifers, aquifer parameters, porosity, specific yield, specific capacity, permeability, transitivity and storage coefficient, types of wells, wellloss, Darcy's law, Dupuit's equation- steady radial flow to wells in confined and unconfined aquifers, yield of a open well-recuperation test. |

| | |
|---|---|
| **TEXT BOOKS** | |
| **1.** | "Engineering Hydrology" by Subramanya, K, Tata McGraw-Hill Education Pvt. Ltd, (2013), NewDelhi. |
| **2.** | "Engineering Hydrology" by Jayarami Reddy, P, Laxmi Publications Pvt. Ltd., (2013), New Delhi. |
| **3.** | "Irrigation and Water Power Engineering" by Punmia B C, P.B.B Lal, A.K. Jainand A.K. Jain (2009), Laxmi Publications Pvt. Ltd., New Delhi. |
| **REFERENCE BOOKS** | |
| **1.** | 'Water Resources Engineering', Mays L.W, Wiley India Pvt. Ltd, (2013). |
| **2.** | 'Hydrology' by Raghunath. H.M., New Age International Publishers,(2010). |
| **3.** | 'Engineering Hydrology –Principles and Practice' by Ponce V.M., Prentice Hall International,(1994). |
| **4.** | 'Hydrology and Water Resources Engineering' by Patra K.C., Narosa Publications,(2011). |
| **5.** | 'Applied hydrology' by Chow V.T., D.R Maidment and L.W. Mays, Tata McGraw Hill Education Pvt.Ltd., Transportation Engineering-Id., (2011), NewDelhi. |
| **6.** | 'Engineering Hydrology' by Ojha C.S.P, R. Berndtsson and P. Bhunya, Oxford University Press,(2010). |
| **WEB REFERENCES** | |
| **1.** | https://www.digimat.in/nptel/courses/video/105104103/L01.html |

# Smart Grid Technologies

| | | | |
|---|---|---|---|
| Course Category | Open Elective | Course Code | 20EE7T30 |
| Course Type | Theory | L-T-P-C | 3-0-0-3 |
| Prerequisites | NIL | Internal Assessment | 30 |
| | | Semester End Examination | 70 |
| | | Total Marks | 100 |

| COURSE OBJECTIVES | |
|---|---|
| 1 | To understand the basic concepts of smart grid. |
| 2 | To understand various smart grid technologies and its usage in smart applications. |
| 3 | To realize substation automation with intelligent sensors and have an idea on battery energy storage systems. |
| 4 | To have basic knowledge on micro grids and DG's. |
| 5 | To have an idea on communication technologies used in smart grid. |

| COURSE OUTCOMES | | |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | **Cognitive Level** |
| CO1 | Know the concepts of smart grids and analyze the smart grid policies and developments in smart grids. | K2 |
| CO2 | Analyze the concepts of smart grid technologies in hybrid electrical vehicles etc. | K4 |
| CO3 | Know the concepts of smart substations - feeder automation - Battery Energy storage systems etc. | K2 |
| CO4 | Analyze micro grids and distributed generation systems. | K4 |
| CO5 | Analyze the effect of power quality in smart grid and to understand latest developments in ICT for smart grid. | K4 |
| K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create | | |

| **Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)** | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
| **CO1** | 3 | 1 | 1 | 1 | 1 | 1 | 1 | - | - | - | - | 1 | 2 | 2 | - |
| **CO2** | 3 | 2 | 1 | 1 | 1 | 1 | 1 | - | - | - | - | 1 | 2 | 2 | - |
| **CO3** | 3 | 2 | 1 | 1 | 1 | 1 | 1 | - | - | - | - | 1 | 2 | 2 | - |
| **CO4** | 3 | 2 | 1 | 1 | 1 | 1 | 1 | - | - | - | - | 1 | 2 | 2 | - |
| **CO5** | 3 | 2 | 1 | 1 | 1 | 1 | 1 | - | - | - | - | 1 | 2 | 2 | - |

| COURSE CONTENT | |
|---|---|
| **UNIT 1** | **Introduction to Smart Grid**<br>Evolution of Electric Grid - Concept of Smart Grid - Definitions - Need of Smart Grid - Functions of Smart Grid - Opportunities & Barriers of Smart Grid - Difference between conventional & smart grid - Concept of Resilient & Self-HealingGrid - Present development & International policies on Smart Grid. |
| **UNIT 2** | **Smart Grid Technologies-1**<br>Introduction to Smart Meters - Real Time Pricing - Smart Appliances - Automatic Meter Reading(AMR) - Outage Management System(OMS) - Plug in Hybrid Electric Vehicles(PHEV) - Vehicle to Grid - Smart Sensors - Home & Building Automation - Phase Shifting Transformers - Net Metering. |
| **UNIT 3** | **Smart Grid Technologies- 2**<br>Smart Substations - Substation Automation - Feeder Automation. Geographic Information System(GIS) - Intelligent Electronic Devices (IED) & their application for monitoring & protection.<br>Smart storage like Battery Energy Storage Systems (BESS) - Super Conducting Magnetic Energy Storage Systems (SMES) - Pumped Hydro - Compressed Air Energy Storage (CAES) |
| **UNIT 4** | **Micro grids and Distributed Energy Resources**<br>Concept of micro grid - need & applications of microgrid - formation of microgrid - Issues of interconnection - protection & control of microgrid - Integration of renewable energy sources - Demand Response. |
| **UNIT 5** | **Information and Communication Technology for Smart Grid**<br>Advanced Metering Infrastructure (AMI) - Home Area Network (HAN) - Neighborhood Area Network (NAN) - Wide Area Network (WAN). |

| TEXT BOOKS | |
|---|---|
| 1 | Integration of Green and Renewable Energy in Electric Power Systems - by Ali Keyhani - Mohammad N. Marwali - Min Dai Wiley - 2009. |
| 2 | The Smart Grid: Enabling Energy Efficiency and Demand Response - by Clark W.Gellings - Fairmont Press - 2009. |
| **REFERENCE BOOKS** | |
| 1 | The Advanced Smart Grid: Edge Power Driving Sustainability:1 by Andres Carvallo - John Cooper - Artech House Publishers July 2011 |
| 2 | Control and Automation of Electric Power Distribution Systems (Power Engineering) by James Northcote - Green - Robert G. Wilson - CRC Press - 2017. |
| 3 | Substation Automation (Power Electronics and Power Systems) by MladenKezunovic - Mark G. Adamiak - Alexander P. Apostolov - Jeffrey George Gilbert - Springer - 2010. |
| 4 | Electrical Power System Quality by R. C. Dugan - Mark F. McGranghan - Surya Santoso -H. Wayne Beaty - McGraw Hill Publication - 2nd Edition. |
| **WEB RESOURCES (Suggested)** | |
| 1 | https://nptel.ac.in/courses/108107113 |
| 2 | https://electrical-engineering-portal.com/smart-grid-concept-and-characteristics |

# Biomedical Instrumentation

| | | | |
|---|---|---|---|
| **Course Category** | Open Elective | **Course Code** | 20EC7T41 |
| **Course Type** | Theory | **L-T-P-C** | 3-0-0-3 |
| **Prerequisites** | Basics of Analog circuits | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **COURSE OBJECTIVES: In this course the student will** | |
|---|---|
| **1** | Study the physiological relation of human body – environment and Identify various errors that occur while measuring living system |
| **2** | Study various types of Electrodes and Transducers used in biomedical measurements |
| **3** | Learn Anatomy of Heart, Respiratory system and the measuring instruments. |
| **4** | Learn various fundamental blocks in patient care and monitoring |
| **5** | Study various diagnostic and therapeutic techniques |

| **COURSE OUTCOMES** | | |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | **Cognitive Level** |
| **CO1** | Acquainted with the function of human body and measure active and resting potentials of cell bodies. | K2 |
| **CO2** | Measure the Bioelectric potential using appropriate electrodes and Transducers. | K2 |
| **CO3** | Know the mechanism and measurement of ECG for the Cardiac cycle and respiratory system | K2 |
| **CO4** | Monitor the Patient care monitoring system and applications of therapeutic equipment | K2 |
| **CO5** | Know the working principles of diagnostic equipment | K2 |

K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.

| **Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
| **CO1** | 2 | 1 | 1 | - | - | - | - | - | - | - | - | - | 1 | - | - |
| **CO2** | 2 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | - | - |
| **CO3** | 1 | 1 | 2 | - | - | - | - | - | - | - | - | - | - | 1 | - |
| **CO4** | - | 1 | 2 | 2 | - | - | - | - | - | - | - | - | - | 1 | - |
| **CO5** | - | 1 | 1 | 1 | 2 | - | - | - | - | - | - | - | 1 | - | - |

| COURSE CONTENT | |
|---|---|
| UNIT I | **INTRODUCTION TO BIOMEDICAL INSTRUMENTATION:** Development of Biomedical Instrumentation, Man Instrumentation System, Components of the Man- Instrument System, Problems Encountered in Measuring a Living System, Bioelectric Potentials, Resting and Action Potentials, Propagation of Action Potential, Bioelectric Potentials-ECG, EEG and EMG, Bio amplifiers |
| UNIT II | **ELECTRODES AND TRANSDUCERS:** Introduction to Electrode Theory, Biopotential Electrodes, Examples of Electrodes, Basic Transducer principles, Biochemical Transducers, The Transducer and Transduction principles, Active Transducers, Passive Transducers. |
| UNIT III | **CARDIOVASCULAR SYSTEM AND MEASUREMENTS:** The Heart and Cardiovascular System, Electro Cardiography, Blood Pressure Measurement, Measurement of Blood Flow and Cardiac Output, Measurement of Heart sound,Plethysmography, Angiogram and Angioplasty<br>**RESPIRATORY SYSTEM AND MEASUREMENTS:** The Physiology of the Respiratory System, Tests and Instrumentation for the Mechanics of Breathing, Respiratory Therapy Equipment. |
| UNIT IV | **PATIENT CARE AND MONITORING:** Elements of Intensive-Care Monitoring, Patient Monitoring Displays, Diagnosis, Calibration and Repair ability of Patient- Monitoring equipmentOther Instrumentation for Monitoring Patients, Pacemakers, Defibrillators, Ventilators, Radio Frequency applications of Therapeutic use, ECG & EEG Recorders. |
| UNIT V | **DIAGNOSTIC TECHNIQUES AND BIO-TELEMETRY:** Principles of Ultrasonic Measurement, Ultrasonic imaging, Ultrasonic Applications of Therapeutic uses, Ultrasonic diagnosis, X-Ray and Radio-Isotope instrumentations, CAT Scan, Emission Computerized Tomography, MRI, and Telemedicine Technology. |

| TEXT BOOKS | |
|---|---|
| 1. | Fundamentals of biomedical instrumentation –Dr.O.N.Pandey, S.K.Kataria & sons,4 th edition,2012 |
| 2. | Bio-Medical Instrumentation – Leslie Cromwell, Fred J.Weibell, Erich A. Pfeiffer, 2nd edition, PHI, 2011. |
| **REFERENCE BOOKS** | |
| 1. | Hand Book of Bio-Medical Instrumentation – R.S.Khandapur, McGrawHill, 2nd edition, 2003 |
| 2. | Biomedical Instrumentation – Dr. M. Arumugam, Anuradha Publications, 2006 |
| **WEB RESOURCES** | |
| 1. | http://www.digimat.in/nptel/courses/video/108105101/L28.html |

# Marketing Management

| | | | |
|---|---|---|---|
| **Course Category** | Open Elective | **Course Code** | 20HM7T04 |
| **Course Type** | Theory | **Lecture-Tutorial-Practice** | 3 -0 -0-3 |
| **Prerequisites** | | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **Course Outcomes** | | **Blooms Taxonomy Level** |
|---|---|---|
| **On successful completion of the course, the student will be able to** | | |
| **CO 1** | Understand the concepts of Marketing and Marketing Environment. | K2 |
| **CO 2** | Analyze the consumer behavior and market segmentation in order to maintain better consumer relations and product positioning respectively. | K4 |
| **CO 3** | Make use of strategies and make decisions based on product life cycle and product mix concepts. | K3 |
| **CO 4** | Understand the pricing effects and select a better distribution channel to reach the consumer. | K2 |
| **CO 5** | Understand the promotional methods and importance. | K2 |

**Contribution of Course Outcomes towards achievement of Program**

Outcomes: 1 – Low, 2 - Medium, 3 – High

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 0 | 0 | 2 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | - | - | - |
| **CO2** | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 2 | 1 | 0 | 1 | 0 | - | - | - |
| **CO3** | 0 | 0 | 1 | 2 | 1 | 2 | 1 | 1 | 0 | 0 | 1 | 1 | - | - | - |
| **CO4** | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | - | - | - |
| **CO5** | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | - | - | - |

| COURSE CONTENT | |
|---|---|
| **UNIT I** | **Introduction to Marketing**: Market and Marketing, Functions, importance and problems of marketing – Marketing Environment, Approaches to the study of marketing – Institutional Approach, Commodity approach, Management approach, systems approach to marketing. Marketing Mix(7 p's of Marketing.) |
| **UNIT II** | **Consumer Behavior and CRM**<br>Meaning and features and Factors influencing Consumer Behavior – Theories of Buying Behavior (Economic theories – Marshallion model, psychological theories, psycho-analytic theories, socio-cultural theories) – buying decision process - Customer Relationship Management.<br>**Market Segmentation**<br>Market Segmentation – Bases of Segmenting Consumer Market and Industrial Market – Target Marketing – Product differentiation – Product Positioning. |
| **UNIT III** | **Product decision**: New product development – Product mix – management of product life cycle – product strategies – product additions and deletions.<br>Branding, packaging and labeling – product differentiation – planned obsolescence. |
| **UNIT IV** | **Pricing and Channels of distribution:**<br>**Pricing:** Pricing objectives – Pricing methods – Pricing strategies.<br>**Channels of Distribution:** Nature and types of marketing channels – wholesale distribution-retail distribution – direct marketing – selection of channels, Logistics, Third Party Service providers. |
| **UNIT V** | **Promotion :** Nature and Importance of promotion – promotional methods of personal selling : objectives and function, Advertising objectives – Message content – media selection – Advertising agency – Advertising Budgets – Measuring Advertising effectiveness; Sales promotion Techniques – Social Media Promotion |

| TEXT BOOKS | |
|---|---|
| **1.** | Phil T.Kotler – Marketing Management - Pearson Education limited – 2019 |
| **2.** | S.A.Sherlekar – Marketing Management - Himalaya Publishing House - 2019 |
| **3.** | Dr. K.Karunakaran – Marketing Management Himalaya Publishing House – 2010. |

| REFERENCE BOOKS | |
|---|---|
| **1.** | Priyanka Goel - Marketing Management – Atlantic publications - 2019. |
| **2.** | Philip Kotler and Lane Keller - Marketing Management – Pearson Educaion ltd – 2017 |
| **3.** | L.Natarajan – Marketing Management – Margham Publications – 2012 |

| WEB REFERENCES | |
|---|---|
| **1.** | https://www.tutorialspoint.com/marketing_management/marketing_management_functions |
| **2.** | https://keydifferences.com/difference-between-branding-and-packaging.html |
| **3.** | https://smallbusiness.chron.com/product-mix-639.html |

# Universal Human Values-II Understanding Harmony

| | | | |
|---|---|---|---|
| **Course Category** | Humanities including Management | **Course Code** | 20HM7T11 |
| **Course Type** | Theory | **Lecture-Tutorial-Practice** | 3 -0 -0 |
| **Prerequisites** | | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 30<br>70<br>100 |

| **Course Outcomes** | | **Blooms Taxonomy Level** |
|---|---|---|
| **On successful completion of the course, the student will be able to** | | |
| **CO 1** | Understand the significance of value inputs in a classroom and start applying them in their life and profession | K2 |
| **CO 2** | Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc. | K1 |
| **CO 3** | Understand the role of a human being in ensuring harmony in society and nature. | K2 |
| **CO 4** | Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work. | K1 |
| **CO 5** | Understand the current scenario in Technology with respect to the Professional Ethics | K2 |

**Contribution of Course Outcomes towards achievement of Program**

Outcomes: 1 – Low, 2 - Medium, 3 – High

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** | **PSO3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | - | - | - | - | - | 3 | - | 3 | - | - | - | 3 | - | - | - |
| **CO2** | - | - | - | - | - | 3 | - | 3 | 3 | - | - | 0 | - | - | - |
| **CO3** | - | - | - | - | - | 3 | 2 | 3 | 3 | - | - | 0 | - | - | - |
| **CO4** | - | - | - | - | - | 3 | - | 3 | 3 | - | - | 0 | - | - | - |
| **CO5** | - | - | - | - | - | 3 | - | 3 | 3 | - | - | 0 | - | - | - |

| COURSE CONTENT | |
|---|---|
| **UNIT I** | **Introduction to Value Education:** Value Education, Definition, Concept and Need for Value Education, Content and Process of Value Education, Basic Guidelines for Value Education, Self exploration as a means of Value Education, Happiness and Prosperity as parts of Value Education. |
| **UNIT II** | **Harmony in the Human Being:** Human Being is more than just the Body, Harmony of the Self (_I') with the Body, Understanding Myself as Co-existence of the Self and the Body, Understanding Needs of the Self and the needs of the Body, Understanding the activities in the Self and the activities in the Body. |
| **UNIT III** | **Harmony in the Family and Society and Harmony in the Nature:** Family as a basic unit of Human Interaction and Values in Relationships, The Basics for Respect and today's Crisis: Affection, Guidance, Reverence, Glory, Gratitude and Love. Comprehensive Human Goal: The Five Dimensions of Human Endeavour, Harmony in Nature: The Four Orders in Nature, The Holistic Perception of Harmony in Existence. |
| **UNIT IV** | **Social Ethics:** The Basics for Ethical Human Conduct, Defects in Ethical Human Conduct,Holistic Alternative and Universal Order, Universal Human Order and Ethical Conduct, Human Rights violation and Social Disparities. |
| **UNIT V** | **Professional Ethics:** Value based Life and Profession, Professional Ethics and Right Understanding, Competence in Professional Ethics, Issues in Professional Ethics – The Current Scenario, Vision for Holistic Technologies, Production System and Management Models. |

| TEXT BOOKS | |
|---|---|
| **1.** | A.N Tripathy, New Age International Publishers, 2003. |
| **2.** | Bajpai. B. L , , New Royal Book Co, Lucknow, Reprinted, 2004 |
| **3.** | Bertrand Russell Human Society in Ethics & Politics |

| REFERENCE BOOKS | |
|---|---|
| **1.** | Corliss Lamont, Philosophy of Humanism |
| **2.** | Gaur. R.R. , Sangal. R, Bagaria. G.P, A Foundation Course in Value Education, Excel Books, 2009. |
| **3.** | Gaur. R.R. , Sangal. R , Bagaria. G.P, Teachers Manual Excel Books, 2009. |
| **4.** | I.C. Sharma . Ethical Philosophy of India Nagin & co Julundhar |
| **5.** | Mortimer. J. Adler, – Whatman has made of man |
| **6.** | William Lilly Introduction to Ethic Allied Publisher |

| WEB REFERENCES | |
|---|---|
| **1.** | https://www.tandfonline.com/doi/abs/10.2753/RSP1061-1967330482?journalCode=mrsp20 |
| **2.** | https://www.thefbcg.com/resource/building-family-harmony-starts-with-living-our-values/#:~:text=What%20does%20family%20harmony%20mean,family%20as%20a%20larger%20unit |

# PRAGATI ENGINEERING COLLEGE
## (Autonomous)
## B.Tech
## Computer Science and Engineering (Artificial Intelligence & Machine Learning)

**R-20**

## Skill Oriented Course-V
### Machine Learning with Go
**CSE ( AI ML)**

| | | | |
|---|---|---|---|
| **Course Category** | Professional Core | **Course Code** | 20AM7S02 |
| **Course Type** | Laboratory | **L-T-P-C** | 1-0-2-2 |
| **Prerequisites** | | **Internal Assessment**<br>**Semester End Examination**<br>**Total Marks** | 00<br>50<br>50 |

| **COURSE OBJECTIVES** | |
|---|---|
| **The student will:** | |
| **1** | To turn the students into a productive, innovative data analyst who can leverage Go to build robust and valuable applications |
| **2** | To introduce the technical aspects of building predictive models in Go, but also helps you understand how machine learning workflows are applied in real-world scenarios. |
| **3.** | To understand how to gather, organize, and parse real-work data from a variety of sources. |
| **4** | To develop a solid statistical toolkit that will allow you to quickly understand gain intuition about the content of a dataset. |
| **5** | To implement essential machine learning techniques (regression, classification, clustering, and so on) with the relevant Go packages. |

| **COURSE OUTCOMES** | | |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | **Cognitive Level** |
| **CO1** | Understand the software Bash Shell. | K2 |
| **CO2** | Understand the software Go – an editor. | K2 |
| **CO3** | Understand various programs on CSV. file | K2 |

**K1: Remember, K2: Understand, K3: Apply, K4: Analyze, K5: Evaluate, K6: Create.**

| **Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)** | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO1** | **PSO2** |
| **CO1** | 3 | 3 | 2 | 2 | 1 | -- | -- | -- | -- | -- | -- | 2 | 3 | 1 |
| **CO2** | 3 | 3 | 2 | 2 | 1 | -- | -- | -- | -- | -- | -- | 2 | 3 | 1 |
| **CO3** | 3 | 3 | 2 | 2 | 1 | -- | -- | -- | -- | -- | -- | 2 | 3 | 1 |

***Prerequisites:***

1. Bash Shell
2. Go-an editor

| List of Experiments | |
|---|---|
| 1 | a) Write a Go program to read CSV file and find the maximum value in a particular column.<br>b) Write a Go program to read iris dataset which is in csv format and demonstrate handling ofunexpected fields, types and manipulating CSV data. |
| 2 | a) Demonstrate how JSON data can be parsed using Go.<br>b) Demonstrate how to connect and Querying SQL like databases (Postgres MySQL, SQLLite) using Go. |
| 3 | emonstrate how to cache data in memory using Go. |
| 4 | a) Demonstrate how to represent matrices and vectors in Go.<br>b) Write a Go program to get statistical measures like mean, median, standard deviation andso on for any dataset.<br>c) Write a Go program to visualize data distributions using Histogram, Box Plots.. |
| 5 | a) Write a Go program to demonstrate Mean Squared Error(MSE), Mean Absolute Error (MAE) , $R^2$ (R Squared).<br>b) Write a Go program to compute Accuracy, Precision , Recall, AUC (Area Under Cover). |
| 6 | a) Demonstrate how to build a linear regression model using Go.<br>b) Demonstrate how to build a multiple linear regression model using Go. |
| 7 | emonstrate how to build a logistic regression model using Go. |
| 8 | pply k-nearest neighbor classifier on iris dataset using Go. |
| 9 | uild a decision tree on iris dataset using Go. |
| 10 | emonstrate K-Means clustering method using Go. |
| 11 | uild auto regressive models for time series data using Go |
| 12 | emonstrate how to build a simple neural network using Go |

**References:**

https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013094429228687360233 3_shared /overview

# MEAN Stack Technologies- MongoDB, Express.js, Angular JS Node.js, and AJAX

## CSE, CSE(AI), CSE(AI&ML), CSE(DS)

| | | | |
|---|---|---|---|
| **Course Category** | Skill Oriented | **Course Code** | 20CS7S07 |
| **Course Type** | Laboratory | **L-T-P-C** | 0-0-3-1.5 |
| **Prerequisites** | | **Total Marks** | 50 |

| **COURSE OBJECTIVES** | |
|---|---|
| **1** | To design dynamic web sites and web applications with Mean Stack Technologies |

| **COURSE OUTCOMES** | | **BTL** |
|---|---|---|
| **Upon successful completion of the course, the student will be able to:** | | |
| **CO1** | Develop a basic web server using Node.js and also working with Node Package Manager (NPM). | K3 |
| **CO2** | Apply Angular built-in or custom pipes to format the rendered data | K3 |
| **CO3** | Make use of MongoDB queries to perform CRUD operations on document database | K3 |

**Note:** K1- Remembering, K2-Understanding, K3-Applying, K4-Analyzing, K5-Evaluating, K6-Creating

| **Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO 10** | **PO 11** | **PO 12** | **PSO1** | **PSO2** | **PSO3** |
| **CO1** | 3 | 2 | 3 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3 | 2 |
| **CO2** | 3 | 2 | 3 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3 | 2 |
| **CO3** | 3 | 2 | 3 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3 | 2 |

| | |
|---|---|
| **COURSE CONTENT**<br>**Software configuration and installation:**<br>**1**. MongoDB<br>TOC - MongoDB Essentials - A Complete MongoDB Guide \| Infosys Springboard (onwingspan.com) | |
| 2. Angular<br>Setup details: Angular Application Setup - Internal - Viewer Page \| Infosys Springboard (onwingspan.com) | |
| **List of Experiments** | |
| 1 | a) Course Name: Node.js<br>Module Name: How to use Node.js<br>Verify how to execute different functions successfully in the Node.js platform.<br>https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_19002830632103186000_shared?collectionId=lex_32407835671946760000_shared&collectionType=Course<br><br>b) Course Name: Node.js<br>Module Name: Create a web server in Node.js<br>Write a program to show the workflow of JavaScript code executable by creating web server in Node.js.<br>https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_28177338996267815000_shared?collectionId=lex_32407835671946760000_shared&collectionType=Course |

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| 2 | a) Course Name: Node.js<br>Module Name: Modular programming in Node.js<br>Write a Node.js module to show the workflow of Modularization of Node application.<br>https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_28865394191004004000_shared?collectionId=lex_32407835671946760000_shared&collectionType=Course<br><br>b) Course Name: Node.js<br>Module Name: Restarting Node Application<br>Write a program to show the workflow of restarting a Node application.<br>https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_9174073856000159000_shared?collectionId=lex_32407835671946760000_shared&collectionType=Course<br><br>c) Course Name: Node.js<br>Module Name: File Operations<br>Create a text file src.txt and add the following data to it. Mongo, Express, Angular, Node.<br>https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_33376440180246100000_shared?collectionId=lex_32407835671946760000_shared&collectionType=Course |
| 3 | a) Course Name: Express.js |

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| | Module Name: Defining a route, Handling Routes, Route Parameters, Query Parameters<br><br>Implement routing for the AdventureTrails application by embedding the necessary code in the routes/route.js file.<br><br>https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_29394215542149950000_shared?collectionId=lex_32407835671946760000_shared&collectionType=Course<br><br>b) Course Name: Express.js<br>Module Name: How Middleware works, Chaining of Middlewares, Types of Middlewares<br><br>In myNotes application: (i) we want to handle POST submissions. (ii) display customized error messages. (iii) perform logging.<br><br>https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_13930661312009580000_shared?collectionId=lex_32407835671946760000_shared&collectionType=Course<br><br>c) Course Name: Express.js<br>Module Name: Connecting to MongoDB with Mongoose, Validation Types and Defaults<br><br>Write a Mongoose schema to connect with MongoDB.<br><br>https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_auth_013035588775485440691_shared?collectionId=lex_32407835671946760000_shared&collectionType=Course<br><br>d) Course Name: Express.js<br>Module Name: Models<br><br>Write a program to wrap the Schema into a Model object.<br><br>https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_auth_013035593896869888662_shared?collectionId=lex_32407835671946760000_shared&collectionType=Course |
| 4 | Course Name: Express.js<br><br>Module Name: CRUD Operations<br><br>Write a program to perform various CRUD (Create-Read-Update-Delete) operations using Mongoose library functions.<br><br>https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_auth_013035684270129152696_shared?collectionId=lex_32407835671946760000_shared&collectionType=Course<br><br>Course Name: Express.js |

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| | Module Name: API Development<br><br>In the myNotes application, include APIs based on the requirements provided. (i) API should fetch the details of the notes based on a notesID which is provided in the URL. Test URL - http://localhost:3000/notes/7555 (ii) API should update the details bas<br><br>https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_auth_01303574525097574475 5_shared?collectionId=lex_324078356719467 60000_shared&collectionType=Course<br><br>Course Name: Express.js<br><br>Module Name: Why Session management, Cookies<br><br>Write a program to explain session management using cookies.<br><br>https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_24299316914857090000_shared?collectionId=lex_32407835671946760000 _shared&collectionType=Course<br><br>Course Name: Express.js<br><br>Module Name: Sessions<br><br>Write a program to explain session management using sessions.<br><br>https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_905413034723449100_shared?collectionId=lex_32407835671946760000_sh ared&collectionType=Course<br><br>Course Name: Express.js<br><br>Module Name: Why and What Security, Helmet Middleware<br><br>Implement security features in myNotes application<br><br>https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_31677453061177940000_shared?collectionId=lex_32407835671946760000 _shared&collectionType=Course |
| 5 | Course Name: Typescript<br><br>Module Name: Basics of TypeScript<br><br>On the page, display the price of the mobile-based in three different colors. Instead of using the number in our code, represent them by string values like GoldPlatinum, PinkGold, SilverTitanium. |

https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_28910354929502245000_shared?collectionId=lex_9436233116512678000_shared&collectionType=Course

Course Name: Typescript

Module Name: Function

Define an arrow function inside the event handler to filter the product array with the selected product object using the productId received by the function. Pass the selected product object to the next screen.

https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_10783156469383723000_shared?collectionId=lex_9436233116512678000_shared&collectionType=Course

Course Name: Typescript

Module Name: Parameter Types and Return Types

Consider that developer needs to declare a function - getMobileByVendor which accepts string as input parameter and returns the list of mobiles.

https://infyspringboard.onwingspan.com/web/en/viewer/hands-on/lex_auth_012712912427057152901_shared?collectionId=lex_9436233116512678000_shared&collectionType=Course

Course Name: Typescript

Module Name: ArrowFunction

Consider that developer needs to declare a manufacturer's array holding 4 objects with id and price as a parameter and needs to implement an arrow function - myfunction to populate the id parameter of manufacturers array whose price is greater than or equ

https://infyspringboard.onwingspan.com/web/en/viewer/hands-on/lex_auth_012712910875500544904_shared?collectionId=lex_9436233116512678000_shared&collectionType=Course

Course Name: Typescript

Module Name: Optional and Default Parameters

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| | Declare a function - getMobileByManufacturer with two parameters namely manufacturer and id, where manufacturer value should passed as Samsung and id parameter should be optional while invoking the function, if id is passed as 101 then this function shoul<br><br>https://infyspringboard.onwingspan.com/web/en/viewer/hands-on/lex_auth_01271291494064128090 6_shared?collectionId=lex_9436233116512678000_shared&collectionType=Course |
| 6 | Course Name: Typescript<br><br>Module Name: Rest Parameter<br><br>Implement business logic for adding multiple Product values into a cart variable which is type of string array.<br><br>https://infyspringboard.onwingspan.com/web/en/viewer/hands-on/lex_auth_01271292186091520090 9_shared?collectionId=lex_9436233116512678000_shared&collectionType=Course<br><br>Course Name: Typescript<br><br>Module Name: Creating an Interface<br><br>Declare an interface named - Product with two properties like productId and productName with a number and string datatype and need to implement logic to populate the Product details.<br><br>https://infyspringboard.onwingspan.com/web/en/viewer/hands-on/lex_auth_01271292524427673691 0_shared?collectionId=lex_9436233116512678000_shared&collectionType=Course<br><br>Course Name: Typescript<br><br>Module Name: Duck Typing<br><br>Declare an interface named - Product with two properties like productId and productName with the number and string datatype and need to implement logic to populate the Product details.<br><br>https://infyspringboard.onwingspan.com/web/en/viewer/hands-on/lex_auth_01271292599545856091 2_shared?collectionId=lex_9436233116512678000_shared&collectionType=Course<br><br>Course Name: Typescript<br><br>Module Name: Function Types<br><br>Declare an interface with function type and access its value.<br><br>https://infyspringboard.onwingspan.com/web/en/viewer/hands- |

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| | on/lex_auth_012712948945346560918_shared?collectionId=lex_9436233116512678000_shared&collectionType=Course |
| 7 | a) Course Name: MongoDB Essentials - A Complete MongoDB Guide<br>Module Name: Installing MongoDB on the local computer, Create MongoDB Atlas Cluster<br>Install MongoDB and configure ATLAS<br>https://infyspringboard.onwingspan.com/web/en/viewer/video/lex_auth_0128182143731302403008 3_shared?collectionId=lex_auth_013177169294712832113_shared&collectionType=Course<br><br>b) Course Name: MongoDB Essentials - A Complete MongoDB Guide<br>Module Name: Introduction to the CRUD Operations<br>Write MongoDB queries to perform CRUD operations on document using insert(), find(), update(), remove()<br>https://infyspringboard.onwingspan.com/web/en/viewer/video/lex_auth_012818218741661696301 18_shared?collectionId=lex_auth_013177169294712832113_shared&collectionType=Course |
| 8 | a) Course Name: MongoDB Essentials - A Complete MongoDB Guide<br>Module Name: Create and Delete Databases and Collections<br>Write MongoDB queries to Create and drop databases and collections.<br>https://infyspringboard.onwingspan.com/web/en/viewer/video/lex_auth_012818216541192192301 21_shared?collectionId=lex_auth_013177169294712832113_shared&collectionType=Course<br><br>b) Course Name: MongoDB Essentials - A Complete MongoDB Guide<br>Module Name: Introduction to MongoDB Queries<br>Write MongoDB queries to work with records using find(), limit(), sort(), createIndex(), aggregate().<br>https://infyspringboard.onwingspan.com/web/en/viewer/video/lex_auth_013289081626451968250 5_shared?collectionId=lex_auth_013177169294712832113_shared&collectionType=Course |
| 9 | a) Course Name: Angular JS<br>Module Name: Angular Application Setup<br>Observe the link http://localhost:4200/welcome on which the mCart application is running. Perform the below activities to understand the features of the application.<br>https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_24049616594198490000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course |

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| | b) Course Name: Angular JS<br>ModuleName: Components and Modules<br>Create a new component called hello and render Hello Angular on the page<br>https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_2821784327964104000 0_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course<br><br>c) Course Name: Angular JS<br>Module Name: Elements of Template<br>Add an event to the hello component template and when it is clicked, it should change the courseName.<br>https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_19226434057992030000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course<br><br>d) Course Name: Angular JS<br>Module Name: Change Detection<br>progressively building the PoolCarz application<br>https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_2560981637120771000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course |
| 10 | a) Course Name: Angular JS<br>Module Name: Structural Directives - ngIf<br>Create a login form with username and password fields. If the user enters the correct credentials, it should render a "Welcome <<username>>" message otherwise it should render "Invalid Login!!! Please try again..." message<br>https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_auth_012763740226043904 2595_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course<br><br>b) Course Name: Angular JS<br>Module Name: ngFor<br><br>Create a courses array and rendering it in the template using ngFor directive in a list format.<br><br>https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_32795774277593590000_shared?collectionId=lex_20858515543254600000_ |

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| | shared&collectionType=Course<br><br>c) Course Name: Angular JS<br>Module Name: ngSwitch<br><br>Display the correct option based on the value passed to ngSwitch directive.<br><br>https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_23388127475984175000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course<br><br>d) Course Name: Angular JS<br>Module Name: Custom Structural Directive<br><br>Create a custom structural directive called 'repeat' which should repeat the element given a number of times.<br><br>https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_24073319904331424000_shared?collectionId=lex_20858515543254600000_shared&collectionType=Course |

| **TEXT BOOKS** | |
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| **1.** | MongoDB – The Definitive Guide, 3rd Edition,2019, Kristina Chodorow, O'Reilly |
| **2** | Programming the World Wide Web, 8th Edition,2014 Robet W Sebesta, Pearson. |
| **3** | Pro Mean Stack Development, 1st Edition,2016 ELadElrom, Apress O'Reilly. |
| **4** | Full Stack JavaScript Development with MEAN, Colin J Ihrig, Adam Bretz, 1st edition,2014 SitePoint, SitePoint Pty. Ltd., O'Reilly Media. |
| **WEB RESOURCES** | |
| **1** | Node JS<br>Download **Node.js** from the official site<br>Setup details : How to use Node.js - Viewer Page \| Infosys Springboard (onwingspan.com) |
| **2** | https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_013177169294712832113_shared/overview (MongoDB) |
| **3** | https://infyspringboard.onwingspan.com/en/app/toc/lex_20858515543254600000_shared/overview (Angular JS) |