**Sri Krishna College of Engineering and Technology**

An Autonomous Institution, Affiliated to Anna University

Coimbatore – 641 008


# DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

CURRICULUM AND SYLLABI

## B.TECH ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

## REGULATION 2020

# SRI KRISHNA COLLEGE OF ENGINEERING AND TECHNOLOGY

## DEPARTMENT OF

## ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

## REGULATION 2020

## B.TECH ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

## ABOUT THE DEPARTMENT

## VISION

To produce globally competitive professionals in Artificial Intelligence and Data Science by imparting cognitive learning and encouraging industry collaboration towards serving the greater cause of society.

## MISSION

1. Impart knowledge in cutting edge Artificial Intelligence and Data Science technologies in par with industrial standards.
2. Inculcate research and lifelong learning that benefit society at large.
3. Promote ethical values and entrepreneurial skills.

### PROGRAMME OUTCOMES (POs)

**Artificial Intelligence and Data Science Graduates will be able to:**

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

**PO2** - **Problem analysis:** Identify, formulate, review 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 the public health and safety, and the 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 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.

## PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

**PEO 1:**
To build a successful career in IT/relevant industry or carryout research in advance areas of Artificial Intelligence, Data Science and address various issues in the society.

**PEO 2:**
To develop problem solving skills and ability to provide solution for real time problems.

**PEO 3:**
To develop the ability and attitude of adapting themselves to emerging technological Challenges

**PEO 4:**
To excel with excellent communication skills, leadership qualities and social responsibilities

## PROGRAMME SPECIFIC OBJECTIVES (PSO)

**PSO 1:**
Understand, analyze and develop innovative solutions for real world problems in industry and research establishments related to Artificial Intelligence and Data Science.

**PSO 2:**
Ability to choose or develop the right tool for Data analysis and develop high end intelligent systems.

**PSO 3:**
Apply programming principles and practices for developing software solutions to meet future business and society needs.

### Mapping of PO's to PEO's

| Programme Educational Objectives (PEO) | Program Outcomes(PO) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| **PEO1** | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 2 | 2 | 3 |
| **PEO2** | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 |
| **PEO3** | 1 | 3 | 1 | 2 | 3 | 2 | 3 | 1 | 1 | 2 | 2 | 2 |
| **PEO4** | 1 | 1 | 3 | 2 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 1 |

### Mapping of Pos to PSOs

| Programme Specific Outcomes (PSO) | Programme Outcomes(PO) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| **PSO1** | 3 | 3 | 3 | 3 | 1 | 2 | 1 | 1 | 1 | 2 | 2 | 2 |
| **PSO2** | 3 | 3 | 3 | 1 | 3 | 1 | 1 | 1 | 2 | 2 | 2 | 3 |
| **PSO3** | 3 | 3 | 3 | 1 | 1 | 3 | 3 | 2 | 3 | 2 | 2 | 3 |

### Mapping of PSO's & PEO's

| Programme Specific Outcomes(PSO) | Programme Educational Objectives(PEO) | | | |
|---|---|---|---|---|
| | PEO1 | PEO2 | PEO3 | PEO4 |
| **PSO1** | 3 | 3 | 2 | 2 |
| **PSO2** | 3 | 3 | 2 | 1 |
| **PSO3** | 3 | 2 | 3 | 3 |

| 1 | Reasonably agreed | 2 | Moderately agreed | 3 | Strongly agreed |
|---|---|---|---|---|---|

| Sem | Course Code | Course | Programme Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** |
| Semester 1 | 20AD101 | Python for Data Science | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 1 | | | 1 | 1 |
| | 20MA101 | Engineering Mathematics I | 2 | 2 | 2 | | | | | | 2 | | | |
| | 20CH101 | Engineering Chemistry | 2 | 2 | 3 | | | | 2 | | 1 | | | |
| | 20AD102 | Computer Organization and Digital Logic | 3 | 3 | 3 | | | | | 2 | | | | |
| | 20AD103 | Python Laboratory | 3 | 3 | 3 | | 2 | | | 2 | 2 | 2 | 2 | 3 |
| | 20ME103 | Engineering Practices laboratory | 3 | 3 | 3 | | 3 | | 3 | | 3 | 2 | | |
| | 20MC101 | Mandatory Course-I (Induction Programme) | | | | | | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Semester 2 | 20GE201 | Universal Human Values | 2 | 2 | 2 | | | 3 | 3 | 3 | 2 | 2 | | 2 |
| | 20MA201 | Engineering Mathematics II | 3 | 3 | 2 | | | | | | 2 | | | |
| | 20EN101 | Technical Communication Skills | | | | | | | | 1 | 3 | 3 | | 2 |
| | 20PH103 | Physics for Computing Science | 2 | 1 | 2 | | | | | | 1 | | | |
| | 20AD201 | Data Structures using C | 3 | 3 | 3 | 3 | 3 | | | | | | | 2 |
| | 20ME111 | Engineering Graphics | 2 | 2 | 1 | | | | 2 | 2 | 3 | | | 2 |
| | 20MC201 | Mandatory Course-II (Environmental Sciences) | | | | | | 2 | 3 | | | | | |

## B.TECH ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

## REGULATION 2020

| SEMESTER I | | | | | | | |
|---|---|---|---|---|---|---|---|
| **S.No** | **Course Code** | **Course** | **L/T/P** | **Contact hrs/week** | **Credit** | **Ext/Int** | **Category** |
| **THEORY** | | | | | | | |
| 1 | 20AD101 | Python for Data Science | 3/0/0 | 3 | 3 | 50/50 | PC |
| **THEORY CUM PRACTICAL** | | | | | | | |
| 2. | 20MA101 | Engineering Mathematics I | 2/1/2 | 5 | 4 | 40/60 | BSC |
| 3. | 20CH101 | Engineering Chemistry | 3/0/3 | 6 | 4.5 | 40/60 | BSC |
| 4. | 20AD102 | Computer Organization and Digital Logic | 3/0/2 | 5 | 4 | 40/60 | ESC |
| **PRACTICAL** | | | | | | | |
| 5. | 20AD103 | Python Laboratory | 0/0/3 | 3 | 1.5 | 40/60 | PC |
| 6 | 20ME103 | Engineering Practices laboratory | 0/0/3 | 3 | 1.5 | 40/60 | ESC |
| **MANDATORY COURSE** | | | | | | | |
| 7. | 20MC101 | Mandatory Course-I (Induction Programme) | 3 weeks | | | | MC |
| **Total** | | | | **25** | **18.5** | **600** | |

| SEMESTER II | | | | | | | |
|---|---|---|---|---|---|---|---|
| **S.No** | **Course Code** | **Course** | **L/T/P** | **Contact hrs/week** | **Credit** | **Ext/Int** | **Category** |
| **THEORY** | | | | | | | |
| 1 | 20GE201 | Universal Human Values | 3/0/0 | 3 | 3 | 50/50 | HSMC |
| **THEORY CUM PRACTICAL** | | | | | | | |
| 2. | 20MA201 | Engineering Mathematics II | 2/1/2 | 5 | 4 | 40/60 | BSC |
| 3. | 20EN101 | Technical Communication Skills | 2/0/2 | 4 | 3 | 40/60 | HSMC |
| 4. | 20PH103 | Physics for Computing Science | 3/0/3 | 6 | 4.5 | 40/60 | BSC |
| 5. | 20AD201 | Data Structures using C | 3/0/2 | 5 | 4 | 40/60 | PC |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 6. | 20ME111 | Engineering Graphics | 1/0/3 | 4 | 2.5 | 40/60 | ESC |
| **MANDATORY COURSE** | | | | | | | |
| 7. | 20MC201 | Mandatory Course-II (Environmental Sciences) | 2/0/0 | 2 | 0 | 0/100 | MC |
| **Total** | | | | **29** | **21** | **700** | |

| **SEMESTER III** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **S.No** | **Course Code** | **Course** | **L/T/P** | **Contact hrs/week** | **Credit** | **Ext/Int** | **Category** |
| **THEORY** | | | | | | | |
| 1 | 20AD301 | Operating Systems | 3/0/0 | 3 | 3 | 50/50 | PC |
| 2. | 20AD302 | Design and Analysis of Algorithms | 3/0/0 | 3 | 3 | 50/50 | PC |
| 3. | 20AD303 | Database Management Systems | 3/0/0 | 3 | 3 | 50/50 | PC |
| 4. | 20AD304 | Artificial Intelligence Principles and Techniques | 3/0/0 | 3 | 3 | 50/50 | PC |
| **THEORY CUM PRACTICAL** | | | | | | | |
| 5. | 20MA305 | Discrete Mathematics | 2/1/2 | 5 | 4 | 40/60 | BSC |
| 6. | 20AD306 | Object Oriented Programming using Java | 3/0/3 | 6 | 4.5 | 40/60 | PC |
| **PRACTICAL** | | | | | | | |
| 7. | 20AD307 | Operating Systems Laboratory | 0/0/3 | 3 | 1.5 | 40/60 | PC |
| 8. | 20AD308 | Database Management Systems Laboratory | 0/0/3 | 3 | 1.5 | 40/60 | PC |
| **MANDATORY COURSE** | | | | | | | |
| 9. | 20MCXXX | Mandatory Course-III | 2/0/0 | 2 | 0 | 0/100 | MC |
| **Total** | | | | **31** | **23.5** | **900** | |

| **SEMESTER IV** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **S.No** | **Course Code** | **Course** | **L/T/P** | **Contact hrs/week** | **Credit** | **Ext/Int** | **Category** |
| **THEORY** | | | | | | | |
| 1 | 20AD401 | Data Warehousing and Mining | 3/0/0 | 3 | 3 | 50/50 | PC |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2. | 20AD402 | Biology for Engineers | 3/0/0 | 3 | 3 | 50/50 | ESC |
| 3. | 20AD403 | Data Communication and Computer Networks | 3/0/0 | 3 | 3 | 50/50 | ESC |
| 4. | 20AD404 | Machine Learning | 3/0/0 | 3 | 3 | 50/50 | PC |
| 5. | 20AD405 | Software Engineering and Management | 3/0/0 | 3 | 3 | 50/50 | HSMC |
| **THEORY CUM PRACTICAL** | | | | | | | |
| 6. | 20MA405 | Probability and Statistics | 2/1/2 | 5 | 4 | 40/60 | BSC |
| **PRACTICAL** | | | | | | | |
| 7. | 20AD406 | Computer Networks Laboratory | 0/0/3 | 3 | 1.5 | 40/60 | ESC |
| 8. | 20AD407 | Machine Learning Laboratory | 0/0/3 | 3 | 1.5 | 40/60 | PC |
| **MANDATORY COURSE** | | | | | | | |
| 9. | 20MCXXX | Mandatory Course-IV | 2/0/0 | 2 | 0 | 0/100 | MC |
| **Total** | | | | **28** | **22** | **900** | |

| **SEMESTER V** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **S.No** | **Course Code** | **Course** | **L/T/P** | **Contact hrs/week** | **Credit** | **Ext/Int** | **Category** |
| **THEORY** | | | | | | | |
| 1. | 20AD501 | Data Science Using R | 3/0/0 | 3 | 3 | 50/50 | PC |
| 2. | 20AD9XX | Professional Elective –I | 3/0/0 | 3 | 3 | 50/50 | PEC |
| 3. | 20AD9XX | Professional Elective –II | 3/0/0 | 3 | 3 | 50/50 | PEC |
| 4. | 20AD0XX | Open Elective –I | 2/0/2 | 4 | 3 | 50/50 | OEC |
| 5. | 20AD502 | Signals and Systems | 3/0/0 | 3 | 3 | 40/60 | ESC |
| **THEORY CUM PRACTICAL** | | | | | | | |
| 6. | 20AD503 | Cloud Computing and its Applications | 3/0/3 | 6 | 4.5 | 50/50 | PC |
| **PRACTICAL** | | | | | | | |
| 7. | 20AD504 | Data Science Laboratory | 0/0/3 | 3 | 1.5 | 40/60 | PC |

| MANDATORY COURSE | | | | | | | |
|---|---|---|---|---|---|---|---|
| 8. | 20MCXXX | Mandatory Course-V | 2/0/0 | 2 | 0 | 0/100 | MC |
| 9. | 20AD505 | Mini Project –I | 0/0/2 | 2 | 1 | 40/60 | PW |
| **Total** | | | | **29** | **22** | **900** | |

| SEMESTER VI | | | | | | | |
|---|---|---|---|---|---|---|---|
| **S.No** | **Course Code** | **Course** | **L/T/P** | **Contact hrs/week** | **Credit** | **Ext/Int** | **Category** |
| **THEORY** | | | | | | | |
| 1. | 20AD601 | AI in Natural Language Processing | 3/0/0 | 3 | 3 | 50/50 | PC |
| 2. | 20AD9XX | Professional Elective –III | 3/0/0 | 3 | 3 | 50/50 | PEC |
| 3. | 20AD9XX | Professional Elective –IV | 3/0/0 | 3 | 3 | 50/50 | PEC |
| 4. | 20ADEXX | Emerging Elective –I | 3/0/0 | 3 | 3 | 50/50 | EEC |
| **THEORY CUM PRACTICAL** | | | | | | | |
| 5. | 20AD602 | Data visualization using Tableau | 3/0/3 | 6 | 4.5 | 40/60 | PC |
| 6. | 20AD603 | Nano Robotics | 3/0/2 | 5 | 4 | 40/60 | ESC |
| **PRACTICAL** | | | | | | | |
| 7. | 20AD604 | NLP Laboratory | 0/0/3 | 3 | 1.5 | 40/60 | PC |
| **PROJECT WORK** | | | | | | | |
| 8. | 20AD605 | Mini Project –II | 0/0/2 | 2 | 1 | 40/60 | PW |
| **Total** | | | | **28** | **23** | **900** | |

| SEMESTER VII | | | | | | | |
|---|---|---|---|---|---|---|---|
| **S.No** | **Course Code** | **Course** | **L/T/P** | **Contact hrs/week** | **Credit** | **Ext/Int** | **Category** |
| **THEORY** | | | | | | | |
| 1 | 20AD701 | Big Data Analytics | 3/0/0 | 3 | 3 | 50/50 | PC |
| 2. | 20AD702 | Deep learning | 3/0/0 | 3 | 3 | 50/50 | PC |
| 3. | 20AD9XX | Professional Elective –V | 3/0/0 | 3 | 3 | 50/50 | PEC |
| 4. | 20AD9XX | Professional Elective –VI | 3/0/0 | 3 | 3 | 50/50 | PEC |
| 5. | 20AD0XX | Open Elective –II | 2/0/2 | 4 | 3 | 50/50 | OEC |
| 6. | 20ADEXX | Emerging Elective –II | 3/0/0 | 3 | 3 | 50/50 | EEC |
| **PRACTICAL** | | | | | | | |
| 7. | 20AD703 | Big Data Analytics Laboratory | 0/0/3 | 3 | 1.5 | 40/60 | PC |
| 8. | 20AD704 | Deep Learning Laboratory | 0/0/3 | 3 | 1.5 | 40/60 | PC |
| **Total** | | | | **25** | **21** | **800** | |

| SEMESTER VIII | | | | | | | |
|---|---|---|---|---|---|---|---|
| **S.No** | **Course Code** | **Course** | **L/T/P** | **Contact hrs/week** | **Credit** | **Ext/Int** | **Category** |
| **Project Work** | | | | | | | |
| 1 | 20AD801 | Project | 0/0/24 | 24 | 12 | 40/60 | PW |
| **Total** | | | | **24** | **12** | **100** | |

**HUMANITIES (9 CREDITS)**

| **S.No** | **Course Code** | **Course** | **L/T/P** | **Contact hrs/week** | **Credit** | **Category** |
|---|---|---|---|---|---|---|
| 1 | 20EN101 | Technical Communication Skills | 2/0/2 | 4 | 3 | HSMC |
| 2 | 20GE201 | Universal Human Values | 3/0/0 | 3 | 3 | HSMC |
| 3. | 20AD405 | Software Engineering and Management | 3/0/0 | 3 | 3 | HSMC |

**BASIC SCIENCES (25 CREDITS)**

| S.No | Course Code | Course | L/T/P | Contact hrs/week | Credit | Category |
|---|---|---|---|---|---|---|
| 1 | 20MA101 | Engineering Mathematics I | 2/1/2 | 5 | 4 | BSC |
| 2 | 20CH101 | Engineering Chemistry | 3/0/3 | 6 | 4.5 | BSC |
| 3 | 20MA201 | Engineering Mathematics II | 2/1/2 | 5 | 4 | BSC |
| 4 | 20PH103 | Physics for Computing Science | 3/0/3 | 6 | 4.5 | BSC |
| 5 | 20MA305 | Discrete Mathematics | 2/1/2 | 5 | 4 | BSC |
| 6 | 20MA405 | Probability and Statistics | 2/1/2 | 5 | 4 | BSC |

**ENGINEERING SCIENCE (22.5 CREDITS)**

| S.No | Course Code | Course | L/T/P | Contact hrs/week | Credit | Category |
|---|---|---|---|---|---|---|
| 1. | 20AD102 | Computer Organization and Digital Logic | 3/0/2 | 5 | 4 | ESC |
| 2. | 20ME103 | Engineering Practices laboratory | 0/0/3 | 3 | 1.5 | ESC |
| 3. | 20ME111 | Engineering Graphics | 1/0/3 | 4 | 2.5 | ESC |
| 4. | 20AD402 | Biology for Engineers | 3/0/0 | 3 | 3 | ESC |
| 5. | 20AD403 | Data Communication and Computer Networks | 3/0/0 | 3 | 3 | ESC |
| 6. | 20AD406 | Computer Networks Laboratory | 0/0/3 | 3 | 1.5 | ESC |
| 7. | 20AD502 | Signals and Systems | 3/0/0 | 3 | 3 | ESC |
| 8. | 20AD603 | Nano Robotics | 3/0/2 | 5 | 4 | ESC |

**PROFESSIONAL CORE ( 62.5 CREDITS)**

| S.No | Course Code | Course | L/T/P | Contact hrs/week | Credit | Category |
|---|---|---|---|---|---|---|
| 1. | 20AD101 | Python for Data Science | 3/0/0 | 3 | 3 | PC |
| 2. | 20AD103 | Python Laboratory | 0/0/3 | 3 | 1.5 | PC |
| 3. | 20AD201 | Data Structures Using C | 3/0/2 | 5 | 4 | PC |
| 4. | 20AD301 | Operating Systems | 3/0/0 | 3 | 3 | PC |
| 5. | 20AD302 | Design and Analysis of Algorithms | 3/0/0 | 3 | 3 | PC |
| 6. | 20AD303 | Database Management Systems | 3/0/0 | 3 | 3 | PC |
| 7. | 20AD304 | Artificial Intelligence Principles and Techniques | 3/0/0 | 3 | 3 | PC |
| 8. | 20AD306 | Object Oriented Programming using Java | 3/0/3 | 6 | 4.5 | PC |
| 9. | 20AD307 | Operating Systems Laboratory | 0/0/3 | 3 | 1.5 | PC |
| 10. | 20AD308 | Database Management Systems Laboratory | 0/0/3 | 3 | 1.5 | PC |
| 11. | 20AD401 | Data Warehousing and Mining | 3/0/0 | 3 | 3 | PC |
| 12. | 20AD404 | Machine Learning | 3/0/0 | 3 | 3 | PC |
| 13. | 20AD407 | Machine Learning Laboratory | 0/0/3 | 3 | 1.5 | PC |
| 14. | 20AD501 | Data Science Using R | 3/0/0 | 3 | 3 | PC |
| 15. | 20AD503 | Cloud Computing and its Applications | 3/0/3 | 6 | 4.5 | PC |
| 16. | 20AD504 | Data Science Laboratory | 0/0/3 | 3 | 1.5 | PC |
| 17. | 20AD601 | AI in Natural Language Processing | 3/0/0 | 3 | 3 | PC |
| 18. | 20AD602 | Data visualization using Tableau | 3/0/3 | 6 | 4.5 | PC |
| 19. | 20AD604 | NLP Laboratory | 0/0/3 | 3 | 1.5 | PC |
| 20. | 20AD701 | Big Data Analytics | 3/0/0 | 3 | 3 | PC |

| | | | | | | |
|---|---|---|---|---|---|---|
| 21. | 20AD702 | Deep learning | 3/0/0 | 3 | 3 | PC |
| 22. | 20AD703 | Big Data Analytics Laboratory | 0/0/3 | 3 | 1.5 | PC |
| 23. | 20AD704 | Deep Learning Laboratory | 0/0/3 | 3 | 1.5 | PC |

**PROFESSIONAL ELECTIVES (18 CREDITS)**

**PROFESSIONAL ELECTIVE I**

| S.No | Course Code | Course | L/T/P | Contact hrs/week | Credits | Category |
|---|---|---|---|---|---|---|
| 1. | 20AD901 | Artificial Neural Networks | 3/0/0 | 3 | 3 | PEC |
| 2. | 20AD902 | Semantic Web | 3/0/0 | 3 | 3 | PEC |
| 3. | 20AD903 | Distributed systems | 3/0/0 | 3 | 3 | PEC |
| 4. | 20AD904 | Virtual and Augmented Reality | 3/0/0 | 3 | 3 | PEC |
| 5. | 20AD905 | Bio Informatics | 3/0/0 | 3 | 3 | PEC |

**PROFESSIONAL ELECTIVE II**

| S.No | Course Code | Course | L/T/P | Contact hrs/week | Credits | Category |
|---|---|---|---|---|---|---|
| 1. | 20AD906 | Ethics in Data Science | 3/0/0 | 3 | 3 | PEC |
| 2. | 20AD907 | Sentiment Analysis | 3/0/0 | 3 | 3 | PEC |
| 3. | 20AD908 | Information Extraction and Retrieval | 3/0/0 | 3 | 3 | PEC |
| 4. | 20AD909 | Cognitive Systems | 3/0/0 | 3 | 3 | PEC |
| 5. | 20AD910 | Intelligent Data Base System | 3/0/0 | 3 | 3 | PEC |

**PROFESSIONAL ELECTIVE III**

| S.No | Course Code | Course | L/T/P | Contact hrs/week | Credits | Category |
|---|---|---|---|---|---|---|
| 1. | 20AD911 | Signal and Image Processing | 3/0/0 | 3 | 3 | PEC |
| 2. | 20AD912 | Computational Statistics for Data Science | 3/0/0 | 3 | 3 | PEC |
| 3. | 20AD913 | Bayesian Data Analysis | 3/0/0 | 3 | 3 | PEC |
| 4. | 20AD914 | Cluster Computing | 3/0/0 | 3 | 3 | PEC |
| 5. | 20AD915 | Business Intelligence | 3/0/0 | 3 | 3 | PEC |

**PROFESSIONAL ELECTIVE IV**

| S.No | Course Code | Course | L/T/P | Contact hrs/week | Credits | Category |
|---|---|---|---|---|---|---|
| 1. | 20AD916 | Scalable System for Data Science | 3/0/0 | 3 | 3 | PEC |
| 2. | 20AD917 | Web and Social media Mining | 3/0/0 | 3 | 3 | PEC |
| 3. | 20AD918 | Game Theory for AI and DS | 3/0/0 | 3 | 3 | PEC |
| 4. | 20AD919 | Edge Computing | 3/0/0 | 3 | 3 | PEC |
| 5. | 20AD920 | Reinforcement Learning | 3/0/0 | 3 | 3 | PEC |

**PROFESSIONAL ELECTIVE V**

| S.No | Course Code | Course | L/T/P | Contact hrs/week | Credits | Category |
|---|---|---|---|---|---|---|
| 1. | 20AD921 | Project Management and Finance | 3/0/0 | 3 | 3 | PEC |
| 2. | 20AD922 | Introduction to Brain and Neuroscience | 3/0/0 | 3 | 3 | PEC |
| 3. | 20AD923 | Intelligent Multi gent and Expert systems | 3/0/0 | 3 | 3 | PEC |
| 4. | 20AD924 | Data Science Applications of NLP | 3/0/0 | 3 | 3 | PEC |
| 5. | 20AD925 | IOT for smart Cities | 3/0/0 | 3 | 3 | PEC |

**PROFESSIONAL ELECTIVE VI**

| S.No | Course Code | Course | L/T/P | Contact hrs/week | Credits | Category |
|---|---|---|---|---|---|---|
| 1. | 20AD926 | Cyber Security | 3/0/0 | 3 | 3 | PEC |
| 2. | 20AD927 | Quantum Artificial Intelligence | 3/0/0 | 3 | 3 | PEC |
| 3. | 20AD928 | Advanced Database Technology and Design | 3/0/0 | 3 | 3 | PEC |
| 4. | 20AD929 | Knowledge Representation and Reasoning | 3/0/0 | 3 | 3 | PEC |
| 5. | 20AD930 | Database Security and Auditing | 3/0/0 | 3 | 3 | PEC |

**OPEN ELECTIVES COURSES (6 CREDITS)**

| S.No | Course Code | Course | L/T/P | Contact hrs/week | Credit | Category |
|---|---|---|---|---|---|---|
| 1. | 20AD001 | Fundamentals of Database Systems | 2/0/2 | 4 | 3 | OEC |
| 2. | 20AD002 | R Programming | 2/0/2 | 4 | 3 | OEC |
| 3. | 20AD003 | Block Chain Fundamentals | 2/0/2 | 4 | 3 | OEC |
| 4. | 20AD004 | Cloud Virtualization | 2/0/2 | 4 | 3 | OEC |
| 5. | 20AD005 | Introduction to Data Analytics | 2/0/2 | 4 | 3 | OEC |
| 6. | 20AD006 | Introduction to Deep Learning | 2/0/2 | 4 | 3 | OEC |

**EMERGING ELECTIVE COURSES (6 CREDITS)**

| S.No | Course Code | Course | L/T/P | Contact hrs/week | Credit | Category |
|---|---|---|---|---|---|---|
| 1. | 20ADE01 | Autonomous Systems and Drones | 3/0/0 | 3 | 3 | EEC |
| 2. | 20ADE02 | Crypto currencies | 3/0/0 | 3 | 3 | EEC |
| 3. | 20ADE03 | AI in Healthcare Applications | 3/0/0 | 3 | 3 | EEC |

| | | | | | | |
|---|---|---|---|---|---|---|
| 4. | 20ADE04 | Predictive Analytics | 3/0/0 | 3 | 3 | EEC |
| 5. | 20ADE05 | Computer Vision | 3/0/0 | 3 | 3 | EEC |
| 6. | 20ADE06 | Data Engineering on Google Cloud Platform | 3/0/0 | 3 | 3 | EEC |

**MANDATORY COURSES**

| S.No | Course Code | Course | Category |
|---|---|---|---|
| 1. | 20MC101 | Induction Programme | MC |
| 2. | 20MC201 | Environmental Sciences | MC |
| 3. | 20MCXXX | MOOC Certification | MC |
| 4. | 20MCXXX | Quantitative Aptitude and Soft Skills | MC |
| 5. | 20MCXXX | Life Skills and Ethics | MC |
| 6. | 20MCXXX | Essence of Indian Traditional Knowledge | MC |
| 7. | 20MCXXX | Stress Management by Yoga | MC |

## Scheme of Distribution

| S.NO | Stream | Credits/Semester | | | | | | | | Credits | AICTE Norms |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | I | II | III | IV | V | VI | VII | VIII | | |
| 1. | Humanities (HSMC) | | 6 | | 3 | | | | | 9 | 12 |
| 2. | Basic Sciences(BSC) | 8.5 | 8.5 | 4 | 4 | | | | | 25 | 24 |
| 3. | Engineering Sciences(ESC) | 5.5 | 2.5 | | 7.5 | 3 | 4 | | | 22.5 | 29 |
| 4. | Professional Core (PC) | 4.5 | 4 | 19.5 | 7.5 | 9 | 9 | 9 | | 62.5 | 49 |
| 5. | Professional Electives(PEC) | | | | | 6 | 6 | 6 | | 18 | 20 |
| 6. | Open Elective(OEC) | | | | | 3 | | 3 | | 6 | 12 |
| 7. | Emerging Electives(EEC) | | | | | | 3 | 3 | | 6 | |
| 8. | Project work (PW) | | | | | 1 | 1 | | 12 | 14 | 15 |
| 9. | Employability Skills | | | | | | | | | 2 | |
| 10. | Mandatory Course (MC) | | | | | | | | | - | |
| **Total** | | 18.5 | 21 | 23.5 | 22 | 22 | 23 | 21 | 14 | 165 | |
| **AICTE(CSE)** | | 17.5 | 20.5 | 23 | 22 | 21 | 22 | 20 | 15 | | 161 |

**20AD101 PYTHON FOR DATA SCIENCE 3/0/0/3**

**Nature of Course**: F (Theory and Programming)

**Course Objectives:**

1. To understand and execute Python script using types and expressions
2. To understand the difference between expressions & statements and to understand the concept of assignment semantics.
3. To utilize high level data types such as lists and dictionaries.
4. To import and utilize a module and to perform read & write operations on files.
5. To use latest python libraries for data science in real time paradigms.

**Course Outcomes:**

**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C101.1 | Recognize the general principles and good Algorithmic problem solving. | [U] |
| C101.2 | Read, write, execute by hand simple Python programs. | [U] |
| C101.3 | Structure simple Python programs for solving problems. | [U] |
| C101.4 | Decompose a Python program into functions. | [AP] |
| C101.5 | Represent compound data using Python lists, tuples and dictionaries. | [AP] |
| C101.6 | Read and write data from data sheets and Analyse data. | [A] |

**Course Contents:**

**Algorithmic Problem Solving, Data, Expressions and Statements: (15 Hrs)**

Algorithms, Building Blocks of Algorithms (Statements, State, Control Flow, Functions), Notation(Pseudo Code, Flow Chart, Programming Language), Algorithmic Problem Solving, Simple Strategies For Developing Algorithms (Iteration, Recursion). Illustrative Problems: Find Minimum In A List, Insert A Card In A List Of Sorted Cards, Guess An Integer Number In A Range, Towers of Hanoi. **-** Python Interpreter And Interactive Mode; Values And Types: Int, Float, Boolean, String, And List; Variables, Expressions, Statements, Tuple Assignment, Precedence of Operators, Comments; Modules And Functions, Function Definition And Use, Flow of Execution, Parameters And Arguments; Illustrative Programs: Exchange The Values of Two Variables, Circulate The Values of N Variables, Distance Between Two Points.

**Control Flow, Functions, Lists, Dictionaries: (15 Hrs)**

Conditionals: Boolean Values And Operators, Conditional (If), Alternative (If-Else), Chained Conditional (If-Elif-Else); Iteration: State, While, For, Break, Continue, Pass; Fruitful Functions: Return Values, Parameters, Local And Global Scope, Function Composition, Recursion; Strings: String Slices, Immutability, String Functions And Methods, String Module; Lists As Arrays. Illustrative Programs: Square Root, GCD. Lists: List Operations, List Slices, List Methods, List Loop, Mutability, Aliasing, Cloning Lists, List Parameters; Tuples: Tuple Assignment, Tuple As Return Value; Dictionaries: Operations And Methods, Exception handling, Files-reading and writing

**Python Libraries for Data Science (15Hrs)**

Basics for Data Science: Loading the Data from CSV file, Cleaning the Data, Visualization, Numpy and Numpy Operations, Pandas and pandas operations, Matplotlib: types of plots.

**Case study:** Analyze the academic performance of students and plot a graph.

**Total Hours: 45**

**Text Books:**

1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist'', 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016. (http://greenteapress.com/wp/think-python/)
2. Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python" – Revised and updated for Python 3.2, Network Theory Ltd., 2011.
3. Fabio Nelli, "Python Data Analytics: Data Analysis and science using pandas, matplotlib and python programming language", Apress.

**Reference Books:**

1. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach", Pearson India Education Services Pvt. Ltd., 2016.
2. Timothy A. Budd, "Exploring Python", Mc Graw Hill Education (India) Private Ltd., 2015.
3. John V Guttag, "Introduction to Computation and Programming Using Python'', Revised and expanded Edition, MIT Press , 2013.
4. Peter Morgan, "Data Analysis from scratch with python: Beginner guide using python, pandas, Numpy, SCIKIT-learn, IPython, TensorFlow and Matplotlib", AI Sciences, 2018.

**Web References:**

1. http://nptel.ac.in/courses/106106145/
2. https://www.codecademy.com/learn/learn-python
3. https://www.coursera.org/learn/python-data-analysis#syllabus

**Online Resources:**

1. https://www.programiz.com/python-programming
2. https://www.fullstackpython.com/best-python-resources
3. https://www.youtube.com/watch?v=edvg4eHi_Mw

| **Assessment Method's and Levels(Based on Bloom's Taxonomy)** | | | |
|---|---|---|---|
| **Formative Assessment Based on Capstone Model(Max.Marks 20)** | | | |
| **Course Outcome** | **Bloom's Level** | **Assessment Components** | **Marks** |
| C101.1 | Understand | Quiz | 3 |
| C101.2 | Understand | Quiz | 2 |
| C101.3 | Apply | Group Discussion | 5 |
| C101.4 | Apply | Problem Solving | 3 |
| C101.5 | Apply | Quiz | 2 |
| C101.6 | Analyze | Assignment | 5 |

| **Summative Assessment Based on Continuous and End Semester Examination** | | | | | |
|---|---|---|---|---|---|
| **Bloom's Level** | **Theory** | | | **Practical** | **End Semester Examinations [40 marks]** |
| | **CIA 1 [10 marks]** | **CIA 2 [10 marks]** | **Term End Assessment [10 marks]** | **Rubric based CIA [30 marks]** | |
| Remember | 30 | 30 | 20 | - | 20 |
| Understand | 40 | 30 | 30 | 30 | 30 |
| Apply | 30 | 40 | 50 | 70 | 50 |
| Analyze | | | | | |
| Evaluate | | | | | |
| Create | | | | | |

| Formative Assessment | Summative Assessment | | Total |
|---|---|---|---|
| | Continuous Assessment | End Semester Examination | |
| 20 | 30 | 50 | 100 |

**Mapping of Course outcomes(CO) with Programme Outcomes(PO) and Programme Specific Outcomes(PSO)**

| Cos | Pos | | | | | | | | | | | | PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | a | b | c | d | e | f | g | h | i | j | k | l | 1 | 2 | 3 |
| C101.1 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 1 | 1 | 2 | 2 | 2 | 3 | 3 |
| C101.2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | | | 2 | 3 | 3 | 3 | 2 |
| C101.3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 1 | 1 | 2 | 2 | 3 | 2 | 2 |
| C101.4 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 3 | | | 2 | 3 | 2 | 2 | 3 |
| C101.5 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | | | 2 | 2 | 3 | 3 | |
| C101.6 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | | | 2 | 2 | 3 | 3 | 3 |

| 3 | Strongly Agree | 2 | Moderately Agreed | 1 | Weekly Agreed |
|---|---|---|---|---|---|

| 20MA101 | ENGINEERING MATHEMATICS I (COMMON TO MECH,MCT,CIVIL,ECE,EEE,CSE,IT,AIDS) | 2/1/2/4 |
|---|---|---|

| | |
|---|---|
| **Nature of Course** | J (Problem analytical) |
| **Pre requisites** | Concept of Differentiation and Matrices |

**Course Objectives:**

| | |
|---|---|
| 1 | To develop the skill to use matrix algebra techniques that is needed by engineers for practical applications. |
| 2 | To know about system of linear equations and its solution set and how to write down the coefficient matrix and augmented matrix of a linear system |
| 3 | To familiarize with functions of several variables applicable in many branches of engineering. |
| 4 | To find the solution of ordinary differential equations as most of the engineering problems are characterized in this form. |

**Course Outcomes:**

**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C101.1 | Recall the concepts of matrices, ordinary and partial derivatives. | [R] |
| C101.2 | Express square matrix in the diagonal form. | [U] |
| C101.3 | Solve systems of linear equations numerically and to find inverse matrices. | [AP] |
| C101.4 | Apply numerical techniques effectively to analyse and visualize data to solve basic engineering-related problems. | [AP] |
| C101.5 | Find the extreme values of the given functions to solve the engineering problems. | [AP] |
| C101.6 | Find the solution of second and higher order differential equations connected with electric circuits and simple harmonic motion. | [AP] |
| | | |

**Course Contents:**

**MATRICES**

Definition – Types of matrices – Characteristic equation – Eigenvalues and eigenvectors of a real matrices and their properties (statement only) – Cayley-Hamilton theorem (statement only) – Verification and application to find inverse and powers of real matrices – Orthogonal transformation of a real symmetric matrix to diagonal form – Reduction of quadratic form to canonical form by Orthogonal transformation.(14)

**SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS**

Newton-Raphson method – Fixed point iteration method– Gauss-Elimination method – Gauss-Jordan method –Iterative methods of Gauss-Jacobi and Gauss-Seidel – Matrix Inversion by Gauss-Jordan method – Eigenvalue of a matrix by Power method and Jacobi method.(16)

**CALCULUS**

Concepts of limits and continuity –Functions of several variables – Total derivatives – Differentiation of implicit functions – Jacobians – Taylor series expansion – Maxima and Minima – Method of Lagrangian multipliers – Ordinary differential equations –Higher order linear differential equations with constant coefficients –Euler Cauchy's equations – Applications of ODE: Solving electrical circuits and simple harmonic motion.
(18)

**Lab Component**

1. Entering row vector, column vector, accessing blocks of elements in MATLAB.
2. Entering matrices, to locate matrix elements and correcting any entry through indexing in MATLAB.
3. Sum, product, transpose, inverse, determinant and rank of a matrices using MATLAB.
4. Eigenvalues and eigenvectors of a matrix using MATLAB.
5. System of linear equations in MATLAB using Gaussian elimination.
6. System of linear equations in MATLAB using matrix inverse method.
7. System of linear equations in MATLAB using linsolve.
8. First and second derivative of single variable functions using MATLAB.
9. Maxima and Minima of a function using MATLAB.
10. Higher Order Equations of constant coefficients using MATLAB.

| | |
|---|---|
| **Total Hours:(48+12)** | **60** |

**Text Books:**


| | |
|---|---|
| 1 | G.B.Thomas and R.L.Finney, Calculus and Analytic Geometry, 14th Edition,Pearson, Reprint,2018 |
| 2 | Kreyszig. E, "Advanced Engineering Mathematics" Tenth Edition, John Wiley and Sons (Asia) Limited, Singapore 2018. |
| 3 | Grewal. B.S, "Higher Engineering Mathematics", 43rd edition, Khanna Publications, Delhi, 2018. |


**Reference Books:**


| | |
|---|---|
| 1 | Veerarajan. T, "Engineering Mathematics I", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2018. |
| 2 | Glyn James, —Advanced Modern Engineering Mathematics, Pearson Education, 4th edition, 2012. |

| | |
|---|---|
| 3 | N.P.Bali and Dr.ManishGoyal,"A Text book of Engineering Mathematics" 9th edition, Laxmi publications ltd, 2014. |
| **Web References:** | |
| 1 | http://www.nptel.ac.in/courses/111105035 |
| 2 | http://www.nptel.ac.in/courses/122104017 |
| 3 | http://nptel.ac.in/courses/122102009 |
| 4 | http://nptel.ac.in/courses/111107063 |
| **Online Resources:** | |
| 1 | https://www.coursera.org/learn/linearalgebra2 |
| 2 | https://www.coursera.org/learn/differentiation-calculus |
| 3 | https://www.coursera.org/learn/single-variable-calculus |
| 4 | https://alison.com/courses/Algebra-Functions-Expressions-and-Equations |

| **20CH101** | **ENGINEERING CHEMISTRY (Common to all I Year B.E. / B.Tech)** | **3 /0 /3 /4.5** |
|---|---|---|
| | | |
| **Nature of Course** | : E (Theory skill based) | |
| **Pre requisites** | : NIL | |
| **Course Objectives:** | | |
| 1 | To make the students conversant with water treatment, boiler feed water techniques. | |
| 2 | To learn the effect of corrosion in materials and the methods for prevention of corrosion. | |
| 3 | To understand the principles and applications of electrochemistry and to learn electro analytical methods. | |
| 4 | To understand the basic concepts, synthesis, and applications of nanomaterials. | |
| 5 | To explore the synthesis and properties of important engineering plastics, energy sources and drug molecules. | |
| 6 | To understand the concepts of photophysical and photochemical processes in spectroscopy. | |
| **Course Outcomes:**<br>**Upon completion of the course, students shall have ability to** | | |
| C101.1 | Recall the requirements of water treatment procedures and boiler feed water for industries. | [R] |
| C101.2 | Apply the various corrosion control techniques in real time industrial environments. | [AP] |
| C101.3 | Understand the principle and working of reference electrodes and conductivity meters as an analyzer. | [U] |
| C101.4 | Understand the basic concepts and applications of Nanochemistry. | [U] |
| C101.5 | Use the knowledge of polymers, various energy sources and storage devices in engineering field. | [AP] |
| C101.6 | Understand the principle and working of certain analytical techniques, and synthesis of some common drug molecules. | [U] |
| | | |
| **Course Contents:** | | |

***Water chemistry and Corrosion:*** Water treatment-characteristics of water-hardness-types and estimation of hardness by EDTA method with numerical problems. Boiler feed water–requirements-disadvantages of hard water. Domestic water treatment-disinfection methods (chlorination, Ozonation, UV treatment)-demineralization process–desalination-reverse osmosis. Corrosion-types–mechanism of dry and wet corrosion-galvanic corrosion-differential aeration corrosion-protective coatings-electroplating of gold-electroless plating of nickel.

***Electrochemistry and Energy sources:*** Electrochemical cells-electrolytic cell-reversible and irreversible cells - Free energy and emf, cell potentials, Nernst equation and applications. Oxidation and reduction potentials-standard hydrogen electrode, saturated calomel electrode, glass electrode-pH measurement. Nanochemistry-Basics-Comparison of molecules, nanomaterials and bulk materials; Types –nanoparticle, nanocluster, nanorod, nanowire and nanotube. Preparation of nanomaterials: Electrochemical deposition and electro spinning. Applications of nanomaterials in medicine. Energy Sources-Fuel cells ($H_2$-$O_2$). Storage Devices-Batteries- Alkaline-Lead acid, Nickel cadmium and Lithium-ion batteries.

***Polymer chemistry, Spectroscopic techniques and Synthesis of drug molecules:*** Introduction-monomers and polymers-classification of polymers-Polymerization-types. Mechanism of addition polymerization (free radical mechanism). Plastics-classification-preparation, properties and uses of Nylon 6,6, Nylon 6, PVC, Bakelite and PET. Moulding methods- moulding of plastics for Car parts, bottle caps (Injection moulding), Pipes, Hoses (Extrusion moulding), Mobile Phone Cases, Battery Trays (Compression moulding) and PET bottles (Blow moulding). Spectroscopy-Beer Lambert's law, principle, instrumentation, and applications of Electronic spectroscopy (UV-visible), Vibrational and rotational spectroscopy (IR) and Flame emission spectroscopy (FES). Synthesis of a commonly used drug molecule-Asprin, p-nitroaniline from acetanilide.

**Field work:**
Industrial visit- Water treatment plant / Sewage treatment plant / Reverse osmosis plant

**Lab Components:**

| | | |
|---|---|---|
| 1 | Estimation of hardness of water by EDTA method | [E] |
| 2 | Estimation of alkalinity of water sample | [E] |
| 3 | Determination of chloride content in bleaching powder | [E] |
| 4 | Estimation of dissolved oxygen in water | [E] |
| 5 | Potentiometry- determination of redox potentials and emf's | [E] |
| 6 | Conductometric titration-mixture of acids vs NaOH | [E] |
| 7 | Determination of strength of strong acid by pH metry | [E] |
| 8 | Corrosion rate of mild steel in acid medium | [E] |
| 9 | Electroplating of nickel over copper | [E] |
| 10 | Spectrophotometry-Estimation of iron in water | [E] |
| 11 | Separation of mixture of amino acids by thin layer chromatography | [E] |
| 12 | Synthesis of Nylon 66 | [E] |
| | **Total Hours:** | **75** |

**Understanding the concepts by simple Demonstrations/Experiments:**

| | |
|---|---|
| 1 | To observe the hardness of given water sample by soap solution test |
| 2 | To view the colour of the different medium of given water sample using litmus paper test |
| 3 | To detect the chlorine content in tap water using simple chemical method |
| 4 | To know the presence of dissolved oxygen in given water sample using glucose by redox principle |

| | |
|---|---|
| 5 | To illustrate the rate of corrosion in steel nails using acid medium |
| **Text Books:** | |
| 1 | Dara S.S, Umare S.S, “Engineering Chemistry”, First revised Edition by S. Chand & Company Ltd., New Delhi 2015. |
| 2 | Jain P. C. & Monica Jain., “Engineering Chemistry”, 16th Edition, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2015. |
| 3 | Fundamentals of Molecular Spectroscopy, 4th Edition by C. N. Banwell Publishing McGraw-Hill Book Company (P) Ltd, England, 1994. |
| 4 | Physical Chemistry, 11th Edition by P. W. Atkins Publishing Oxford University Press (P) Ltd, United Kingdom, 2018. |
| 5 | Nanochemistry, 2nd Edition by K. Klabunde, G. Sergeev Springer Publisher, 2013. |
| 6 | N.Krishna Murthy, Vallinayagam D.,”Engineering Chemistry” 3rd Edition by PHI Learning Pvt Ltd.,2014 |
| 7 | Sunita Rattan, A Text Book of Engineering Chemistry, Student Edition by SK Kataria Publishers, 2013. |
| 8 | R.V.Gadag, A.Nithyananda Shetty “Engineering Chemistry” 3rd Edition PHI Learning Pvt Ltd., 2014. |
| **Reference Books:** | |
| 1 | Shikha Agarwal., “Engineering Chemistry and Applications”, Cambridge University press, 2016. |
| 2 | Liliya.,Bazylak.I.,Gennady.E.,Zaikov.,Haghvi.A.K.,”Polymers and Polymeric Composites” CRC Press,2014. |
| 3 | Lefrou.,Christine.,Fabry.,Pierre.,Poignet.,Jean-claude.,”Electrochemistry - The Basics, with examples” 2012 ., Springer. |
| 4 | Zaki Ahmad, Digby Macdonald, “Principles of Corrosion Engineering and Corrosion Control”, Elsevier Science, 2nd Edition 2012. |
| 5 | Perez, Nestor,”Electrochemistry and Corrosion Science”, Springer, 2016. |
| 6 | Introduction to Nano: basics to Nanoscience and Nanotechnology, by Sengupta, Amretashis, Sarkar, Chandan Kumar, Springer Publisher, 2015. |
| 7 | Ghazi A.Karim. “Fuels, Energy and the Environment”, CRC Press, Taylor and Francis group, 2012. |
| **Web References:** | |
| 1 | http://www.analyticalinstruments.in/home/index.html |
| 2 | www.springer.com › Home › Chemistry › Electrochemistry |
| 3 | https://www.kth.se/.../electrochem/welcome-to-the-division-of-applied-electrochemistry |
| 4 | www.edx.org/ |
| 5 | https://www.ntnu.edu/studies/courses |
| 6 | www.corrosionsource.com/ |
| **Online Resources:** | |
| 1<br>2<br>3<br>4<br>5<br>6 | nptel.ac.in/courses/105104102/hardness.htm<br>https://ocw.mit.edu/courses/chemistry<br>nptel.ac.in/courses/105106112/1_introduction/5_corrosion.pdf https://alison.com - Spectroscopic technique, Colorimetry<br>https://ocw.mit.edu/courses/chemistry<br>nptel.ac.in/courses/113108051 |

**20AD102 COMPUTER ORGANIZATION AND DIGITAL LOGIC 3/0/2/4**

**Nature of Course** : F (Theory Programming)
**Pre requisites** : Nil

**Course Objectives:**

1. To study the concepts of the basic structure and operation of a digital computer.
2. To understand the concepts of algorithmic problem solving.
3. To learn the working of different types of arithmetic operations.
4. To understand the basics of sequential logic devices and the design of sequential circuits.
5. To learn the working of different types of memories and advanced processor architecture.

**Course Outcomes:**

**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C102.1 | Recognize the general principles and good Algorithmic problem solving. | [R] |
| C102.2 | Choose different ways of representing problem solving methodologies. | [U] |
| C102.3 | To encode information in binary and to manipulate Boolean functions using Boolean algebra. | [AP] |
| C102.4 | To minimize Boolean functions and implement them using digital logic gates. | [U] |
| C102.5 | Recognize the design of the various units of digital computers that store and process information via instructions. | [R] |
| C102.6 | Review the functionality of all components and connectivity to the Central Processing Unit. | [U] |

**Course Contents:**

**Number Systems and Boolean Algebra (15 Hrs)**

Introduction -Base conversion-Binary codes- Complements. **Boolean Algebra**: Properties of boolean algebra-Boolean functions – Minimization of Boolean Functions using Karnaugh Maps Implementation of Logic Circuits using Gates – Code Conversion- **Combinational Logic** – Combinational circuits- Binary Adder - Subtractor - Decimal Adder - Binary Multiplier – Decoders - Encoders - **Sequential Logic**- Flip-flops, Triggering of Flip-flops, Analysis of clocked sequential circuits, Design Procedure .

**Architecture Fundamentals and Memory Organization: (15 Hrs)**

Organization of the Von Neumann Machine - Basic Operational Concepts of a Machine - Memory Locations and Addresses – Instruction Format - Instruction Sets, Addressing Modes and Assembly Language. Memory Organization**:** Basic Concepts, Semiconductor RAMs, ROMs, Cache memories, Performance Consideration, Virtual Memory and Memory Management requirements - Secondary storages.

**Advanced Architecture:** **(15 Hrs)**

Parallel processing challenges – Flynn's classification – SISD, MIMD, SIMD, SPMD, and Vector Architectures – Hardware multithreading – Multi-core processors and other Shared Memory Multiprocessors – Introduction to Graphics Processing Units, Clusters, Warehouse Scale Computers and other Message-Passing Multiprocessors.

**Total Hours: 45**

**Lab Exercises**

1. Realization of Boolean Functions Using Logic Gates
2. Analysis and Synthesis of Combinational Logic Circuits
3. Design and implement combinational circuits using MSI devices:
   - 4 –bit binary adder / subtractor
   - Parity generator / checker
   - Magnitude Comparator
   - Application using multiplexers
4. Design and implementation of a simple digital system
5. Design and Implementation of Shift Registers.
6. Design and Implement synchronous counters.
7. Memory unit design and perform memory operations.
8. Interfacing of CPU and Memory

**Total Hours: 15**

**Text Books:**


1. David A. Patterson and John L. Hennessy Computer Organization and Design-The Hardware/Software Interface 5th edition, Morgan Kaufmann, 2013.
2. Carl Hamachar, ZvoncoVranesic and SafwatZaky, "Computer Organization", McGraw- Hill, 6th Edition 2018.
3. M. Morris R. Mano, Michael D. Ciletti, "Digital Design: With an Introduction to the Verilog HDL, VHDL, and SystemVerilog", 6th Edition, Pearson, 2018.


**Reference Books:**


1. William Stallings, Computer Organization and Architecture –Designing for Performance, Eighth Edition, Pearson Education, 2010.

2. John F. Wakerly, "Digital Design: Principles and Practices", 5th Edition, Pearson, 2018.

3.Donald P leach, Albert Paul Malvino, GoutamSaha,"Digital Principles and Application", 8th Edition., McGraw Hill education (India) Private Limited, 2015.

**Web References:**

1. http://www.hp.com/hpinfo/newsroom/press_kits/2013/hpmoonshot2013/DS_Moonshot_System.pdf
2. https://www.hpe.com/h20195/v2/getpdf.aspx/c04168328.pdf?ver=11
3. http://documents.opto22.com/casestudies/2183_Case_Study_San_Diego_Supercomputer_Center.pdf

**Online Resources:**

1. https://www.coursera.org/learn/making-architecture
2. https://www.coursera.org/learn/comparch
3. http://nptel.ac.in/video.php?subjectId=106102062
4. http://nptel.ac.in/courses/106102062/

| **Assessment Methods & Levels (based on Blooms' Taxonomy)** | | | | | |
|---|---|---|---|---|---|
| **Summative assessment based on Continuous and End Semester Examination** | | | | | |
| **Bloom's Level** | **Continuous Assessment** | | | | **End Semester Examination (Theory) [40 marks]** |
| | **Theory** | | | **Practical** | |
| | **CIA1 [10 Marks]** | **CIA2 [10marks]** | **CIA3 [10marks]** | **Rubric based CIA [30 Marks]** | |
| Remember | - | - | - | - | - |
| Understand | 50 | 10 | 20 | - | 10 |
| Apply | 50 | 50 | 40 | 30 | 50 |
| Analyze | - | 40 | 40 | 20 | 40 |
| Evaluate | - | - | - | 20 | - |
| Create | - | - | - | 30 | - |

**Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)**

| **COs** | **Pos** | | | | | | | | | | | | **PSOs** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **a** | **b** | **c** | **d** | **e** | **f** | **g** | **h** | **i** | **J** | **k** | **l** | **1** | **2** | **3** |
| C102.1 | 3 | 3 | 3 | 3 | | | | | | | | 2 | 3 | 2 | 1 |
| C102.2 | 2 | 3 | 3 | 2 | 2 | | | | | | | 2 | 3 | 1 | 1 |
| C102.3 | 3 | 3 | 3 | 2 | 3 | | | | | | | 2 | 3 | 3 | 1 |
| C102.4 | 2 | 3 | 3 | 3 | 2 | | | | | | | | 2 | 2 | 2 |
| C102.5 | 2 | 2 | 3 | 1 | 2 | | | | | | | | 3 | 3 | 2 |
| C102.6 | 3 | 3 | 3 | 3 | 3 | | | | | | | 1 | 3 | 1 | 2 |

| 3 | Strongly agreed | 2 | Moderately agreed | 1 | Weakly agreed |
|---|---|---|---|---|---|

**20AD103 PYTHON LABORATORY 0/0/3/1.5**

**Nature of Course**: L (Programming)

**Course Objectives**:

1. To understand and execute Python script using types and expressions.
2. To understand the difference between expressions & statements and to understand the concept of assignment semantics.
3. To utilize high level data types such as lists and dictionaries.
4. To import and utilize a module and to perform read & write operations on files.
5. To use latest python libraries for data science in real time paradigms.

**Course Outcomes:**

Upon completion of the course, students shall have ability to

| | | |
|---|---|---|
| C103.1 | Recognize the general principles and good Algorithmic problem solving. | [U] |
| C103.2 | Read, write, execute by hand simple Python programs. | [U] |
| C103.3 | Structure simple Python programs for solving problems. | [U] |
| C103.4 | Decompose a Python program into functions. | [AP] |
| C103.5 | Represent compound data using Python lists, tuples and dictionaries. | [AP] |
| C103.6 | Read and write data from data sheets and Analyse data. | [A] |

**Laboratory Experiments:**

1. Programs for Familiarizing with the syntax and basic concepts
2. Programs to perform various string operations
3. Implementing conditional, control and repetition statements.
4. Creating Functions and recursive functions.
5. Programs for Familiarizing File operations
6. Initializing Packages and implementing programs based on it
7. Creating and processing data files.
8. Implementing GUI using turtle
9. Loading Data with Numpy
10. Visualizing the data using matplot lib

**Total Hours: 45**

**Text Books:**


1. Allen B. Downey, “Think Python: How to Think Like a Computer Scientist’’, 2nd edition, Updated for Python 3, Shroff/O’Reilly Publishers, 2016. (http://greenteapress.com/wp/think-python/)
2. Guido van Rossum and Fred L. Drake Jr, “An Introduction to Python” – Revised and updated for Python 3.2, Network Theory Ltd., 2011.
3. Fabio Nelli, ”Python Data Analytics: Data Analysis and science using pandas, matplotlib and python programming language”, Apress.


Reference Books:


1. Robert Sedgewick, Kevin Wayne, Robert Dondero, “Introduction to Programming in Python: An Inter-disciplinary Approach”, Pearson India Education Services Pvt. Ltd., 2016.
2. Timothy A. Budd, “Exploring Python”, Mc Graw Hill Education (India) Private Ltd., 2015.

3. John V Guttag, “Introduction to Computation and Programming Using Python’’, Revised and expanded Edition, MIT Press , 2013.
4. Peter Morgan, ”Data Analysis from scratch with python: Beginner guide using python, pandas, Numpy, SCIKIT-learn, IPython, TensorFlow and Matplotlib”, AI Sciences, 2018.

Web References:

1. http://nptel.ac.in/courses/106106145/
2. https://www.codecademy.com/learn/learn-python
3. https://www.coursera.org/learn/python-data-analysis#syllabus

Online Resources:

1. https://www.programiz.com/python-programming
2. https://www.fullstackpython.com/best-python-resources
3. https://www.youtube.com/watch?v=edvg4eHi_Mw

| **20ME103** | **ENGINEERING PRACTICES LABORATORY** | **0/0/3/1.5** |
|---|---|---|
| **Nature of Course** | Practical application | |
| **Pre Requisites** | Nil | |

**Course Objectives:**

| | |
|---|---|
| 1 | To learn the use of basic hand tools and to know the need for safety in work place and to gain hands on experience in Carpentry, Sheet metal, Plumbing, Welding and Foundry. |
| 2 | To learn about basic electrical devices, meters and electronics devices and to gain knowledge about the fundamentals of various electrical and electronic gadgets their working and trouble shooting. |

**Course Outcomes:**
**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C103.1 | Identify and solve the basic engineering problems at home and in workplace. | [Ap] |
| C103.2 | Develop the surfaces and make simple components like tray and funnel. | [C] |
| C103.3 | Make simple metal joints using welding equipment and wooden joints using carpentry tools. | [Ap] |
| C103.4 | Prepare pipe connections and sand moulds. | [Ap] |
| C103.5 | Understand the fundamentals of hot forging and injection moulding | [U] |
| C103.6 | Examine and troubleshoot electrical and electronic circuits | [A] |

**Course Contents:**

**GROUP A (CIVIL & MECHANICAL)**

Manufacturing Methods –Sheet metal operations - Welding - arc welding, gas welding, Study of TIG & MIG welding. Study of foundry, Demonstration of Smithy and Injection moulding - Carpentry work using power tools - Plumbing components and pipelines

**List of Experiments:**

| S.No | List of Experiments | CO Mapping | RBT |
|---|---|---|---|
| 1 | Preparation of butt joints and lap joints using arc welding | C103.3 | [Ap] |
| 2 | Sheet metal Forming and Bending, Model making – Trays and funnels. | C103.2 | [C] |
| 3 | Preparation of wooden joints by sawing, planning and cutting. | C103.3 | [Ap] |
| 4 | Making basic pipe connections involving the fittings like valves, taps, coupling, unions, reducers, elbows and other components used in household fittings. | C103.4 | [Ap] |
| 5 | Demonstration of foundry operations like mould preparation for solid and split piece pattern. | C103.4 | [U] |
| 6 | Demonstration of Smithy operations | C103.5 | [Ap] |
| 7 | Demonstration of assembly of pump / Demonstration of Injection | C103.5 | [Ap] |

| | | | |
|---|---|---|---|
| | moulding | | |

**GROUP B (ELECTRICAL AND ELECTRONICS ENGINEERING)**

**List of Experiments:**

Basic Circuit Elements: Resistor, inductor, capacitor. Introduction to measuring equipments: Moving iron meter, moving coil meter, Wattmeter, Energy meter, CRO, Multi-meter. Digital logic circuits, PCB design, fuse, relay, circuit breaker, wire, Earthing, fan, fluorescent lamp, iron box, mixer grinder, study of FM radio and mobile phone.

| S.No | List of Experiments | CO Mapping | RBT |
|---|---|---|---|
| 1 | Study and identification of electronic components with specification. | C103.6 | [U] |
| 2 | Testing of CRO and Electronic components using Multimeter. | C103.6 | [A] |
| 3 | Generation and measurement of signals using CRO. | C103.6 | [A] |
| 4 | Familiarisation of digital basic gate IC's. | C103.6 | [AP] |
| 5 | Soldering practice-components devices and circuits- using general purpose PCB. | C103.6 | [AP] |
| 6 | Demonstration of meters and electrical components. | C103.6 | [AP] |
| 7 | Safety precautions with electrical components. | C103.6 | [AP] |
| 8 | Residential house wiring. | C103.6 | [A] |
| 9 | Measurement of power and energy. | C103.6 | [A] |
| 10 | Trouble shooting of electrical equipments. | C103.6 | [A] |
| | | **Total Hours:** | **45** |

**Reference Books:**

| | |
|---|---|
| 1 | Serope Kalpakjian and Steven R. Schmid, "Manufacturing Engineering and Technology", Pearson Education, Inc. 2009 (Second Indian Reprint). |
| 2 | Hajra Choudhury, "Elements of Workshop Technology", Vol. I & II, Media Promotors Pvt Ltd., 2014. |
| 3 | Suyambazhagan S, 'Engineering practices' PHI Learning private limited, New Delhi, 2012. |
| 4 | D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010. |
| 5 | E. Hughes, "Electrical and Electronics Technology", Pearson, 2010. |

**Web References:**

| | |
|---|---|
| 1 | www.nptel.ac.in |
| 2 | www.sme.org |
| 3 | http://www.allaboutcircuits.com/education/ |

**Tentative Assessment Methods & Levels (based on Bloom's Taxonomy)**

**Summative assessment based on Continuous and End Semester Examination**

| Bloom's Level | Rubric based Continuous Assessment [60 marks] | End Semester Examination [40 marks] |
|---|---|---|
| Remember | 10 | 10 |
| Understand | 10 | 10 |
| Apply | 40 | 40 |
| Analyze | 20 | 20 |
| Evaluate | 10 | 10 |
| Create | 10 | 10 |

| 20GE201 | UNIVERSAL HUMAN VALUES<br>(All Branches) | 3 /0 /0 /3 |
|---|---|---|

| | |
|---|---|
| **Nature of Course** | C ( Theory Concept) |
| **Pre requisites** | Interpersonal Communication and Value Sciences |

**Course Objectives:**

| | |
|---|---|
| 1 | Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence. |
| 2 | Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence. |
| 3 | Strengthening of self-reflection. |
| 4 | Development of commitment and courage to act. |
| 5 | Helping the students to appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity, which are the core aspirations of all human beings |
| 6 | Highlighting plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature |

**Course Outcomes:**
**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C201.1 | Understand about themselves and their surroundings (family, society, nature). | [U] |
| C201.2 | Understand and take responsibilities in life and handle problems to attain sustainable solutions while keeping human relationships and human nature in mind. | [U] |
| C201.3 | Apply responsibilities towards their commitments (human values, human relationship and human society). | [AP] |
| C201.4 | Apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction. | [AP] |
| C201.5 | Analyse ethical and unethical practices, and formulate strategies to actualize a harmonious environment wherever they work. | [AN] |
| C201.6 | Understand the harmony in nature and existence, and work out mutually on fulfilling participation in the nature. | [U] |

**Course Contents:**

**Module 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education, Understanding Harmony in the Human Being - Harmony in Myself!**

Purpose and motivation for the course. Self-Exploration–Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration. Continuous Happiness and Prosperity- A look at basic Human Aspirations. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario. Method to fulfil the above human aspirations: understanding and living in harmony at various levels. Understanding human being as a co-existence of the sentient 'I' and the 'Material Body'. Understanding the needs of Self ('I') and 'Body' - happiness and physical Facility. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer). Understanding the characteristics and activities of 'I' and harmony in 'I'. Understanding the harmony of 'I' with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail-Programs to ensure Sanyam and Health.

**Module 2: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship, Understanding Harmony in the Nature and Existence - Whole existence as Coexistence**

Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship. Understanding the meaning of Trust; Difference between intention and Competence. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family. Understanding the harmony in the Nature. Interconnectedness and mutual fulfilment among the four orders of nature recyclability and self regulation in nature. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space. Holistic perception of harmony at all levels of existence.

**Module 3: Implications of the above Holistic Understanding of Harmony on Professional Ethics**

Natural acceptance of human values. Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for the above production systems. Case studies of typical holistic technologies, management models and eco-friendly production systems. Strategy for transition from the present state to Universal Human Order: a. Individual level: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations. Sum up.

| | |
|---|---|
| **Total Hours:** | **30** |
| **Text Books:** | |
| 1 | Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books,New Delhi, 2010 |
| 2 | Rajni Setia, Priyanka Sharma, " Human Values", Genius Publication", Jaipur,2019. |
| **Reference Books:** | |
| 1 | Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004. |
| 2 | The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi |
| 3 | India Wins Freedom - Maulana Abdul Kalam Azad. |
| **Web References:** | |
| 1 | https://examupdates.in/professional-ethics-and-human-values/ |
| 2 | http://hvpe1.blogspot.com/2016/06/notes-human-values-and-professional.html |
| 3 | https://www.yourmorals.org/schwartz.2006.basic%20human%20values.pdf |
| **Online Resources:** | |
| 1 | https://nptel.ac.in/courses/109/104/109104068/ |
| 2 | https://medium.com/the-mission/the-12-important-life-skills-i-wish-id-learned-in-school-f4593b49445b |
| 3 | https://www.thebalancecareers.com/life-skills-list-and-examples-4147222 |

**Assessment Methods & Levels (based on Bloom'sTaxonomy)**

**Formative assessment based on Capstone Model (Max. Marks:20)**

| Course Outcome | Bloom's Level | Assessment Component | Marks |
|---|---|---|---|
| C201.1 | Understand | Group Discussion | 5 |
| C201.2 | Understand | Book Review | 5 |

| | | | |
|---|---|---|---|
| C201.3&4 | Apply | Role Play | 5 |
| C201.5&6 | Apply | Formal Presentation | 5 |

**Summative assessment based on Continuous and End Semester Examination**

| Bloom's Level | Continuous Assessment | | | |
|---|---|---|---|---|
| | CIA-I [10 marks] | CIA-II [10 marks] | CIA-III [10 marks] | Term End Assessment [50 marks] |
| Remember | 20 | 20 | 20 | 20 |
| Understand | 40 | 40 | 40 | 40 |
| Apply | 40 | 40 | 40 | 40 |
| Analyse | - | - | - | - |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |

| **20MA201** | **ENGINEERING MATHEMATICS II (COMMON TO MECH,MCT,CIVIL,ECE,EEE,CSE,IT,AIDS)** | **2/1/2/4** |
|---|---|---|

| | |
|---|---|
| **Nature of Course** | J (Problem analytical) |
| **Pre requisites** | Concepts of Differentiation and Integration. |

**Course Objectives:**

| | |
|---|---|
| 1 | To gain knowledge in integrals, which are needed in engineering applications. |
| 2 | To develop logical thinking and analytical skills in evaluating multiple integrals. |
| 3 | To acquaint with the concepts of vector calculus needed for problems in all engineering disciplines. |
| 4 | To impart the knowledge of Laplace transform, to find solutions of initial value problems for linear ordinary differential equations. |

**Course Outcomes:**
**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C201.1 | Determine the area and volume by applying the techniques of double and triple integrals. | [R] |
| C201.2 | Finding the values of integrals through different numerical methods. | [U] |
| C201.3 | Differentiate and integrate a vector-valued functions to solve real world applications. | [AP] |
| C201.4 | Calculate grad, div, curl and use Gauss, Stokes and Greens theorem to simplify the calculations of integrals. | [AP] |
| C201.5 | Apply Laplace transform techniques in system modelling, digital signal processing, process control, solving boundary value problems. | [AP] |
| C201.6 | Apply Laplace transform methods for solving linear differential equations. | [AP] |

**Course Contents:**

**INTEGRAL CALCULUS**

Definite integrals: Evaluation of definite integrals using Bernoulli's formula –Multiple Integrals: Double integration in Cartesian coordinates –Area as double integral –Change of order of Integration – Triple integration in Cartesian co-ordinates –Volume as triple integral –Beta and Gamma functions – Relation between Beta and Gamma Functions – Evaluation of Integrals using Beta and Gamma Functions – Numerical integration:Trapezoidal rule and Simpson's rulefor single and double integrals. (18)

**VECTOR CALCULUS**

Vector differential operator – Gradient of a scalar point function - Directional derivatives –Divergence and Curl of a vector point function – Irrotational and solenoidal vector fields –Simple problems – Vector integration – Green's theorem in a plane, Gauss divergence theorem and Stoke's theorem (theorems

statements only)– Simple applications involving cubes and rectangular parallelepipeds. (14)

**LAPLACE TRANSFORM**

Convergence of Laplace transform – Transform of some standard functions –Unit step function – Unit Impulse function – Properties – Initial and final value theorem – Inverse Laplace transform – Partial fraction method – Convolution theorem – Application of Laplace transform for solving second orderordinary differential equation. (16)

**Lab Components:**

1. Double integrals evaluation in cartesian coordinates using MATLAB.
2. Triple integral calculations using MATLAB in cartesian and cylindrical coordinates.
3. Double integral evaluation in MATLAB by Trapezoidal rule.
4. Evaluation of gradient, curl and divergence in MATLAB.
5. Line integral over a vector field using MATLAB
6. Applying Green's theorem to solve integrals in MATLAB.
7. Relation between Laplace transform of function and its derivative using MATLAB.
8. Laplace transform of Dirac delta and Heaviside functions in MATLAB.
9. Solving Differential Equations in MATLAB using Laplace Transform.
10. Inverse Laplace Transformof symbolic expressions using MATLAB.

| | |
|---|---|
| **Total Hours:(48+12)** | **60** |
| **Text Books:** | |
| 1 | G.B.Thomas and R.L.Finney, Calculus and Analytic Geometry, 14$^{th}$Edition, Pearson, Reprint,2018. |
| 2 | Kreyszig. E, “Advanced Engineering Mathematics” Tenth Edition, John Wiley and Sons (Asia) Limited, Singapore 2018. |
| 3 | Grewal. B.S, “Higher Engineering Mathematics”, 43$^{rd}$ edition, Khanna Publications, Delhi, 2014. |
| **Reference Books:** | |
| 1 | Veerarajan. T, “Engineering Mathematics II”,Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2018. |
| 2 | Glyn James, —Advanced Modern Engineering Mathematics, Pearson Education, 4$^{th}$ edition, 2012. |
| 3 | N.P.Bali and Dr.ManishGoyal,”A Text book of Engineering Mathematics” 9$^{th}$ edition, Laxmi publications ltd, 2014. |
| **Web References:** | |
| 1 | http://nptel.ac.in/video.php?subjectId=122107037 |
| 2 | http://nptel.ac.in/courses/122107036/ |
| 3 | http://nptel.ac.in/video.php?subjectId=117102060 |
| **Online Resources:** | |
| 1 | https://www.coursera.org/learn/pre-calculus |
| 2 | https://www.coursera.org/learn/linearalgebra1 |
| 3 | https://alison.com/courses/Advanced-Mathematics-1 |
| 4 | https://www.edx.org/course/algebra-lineal-mexicox-acf-0903-1x. |

**Assessment Methods & Levels (based on Blooms’ Taxonomy)**

| Summative assessment based on Continuous and End Semester Examination | | | | | |
|---|---|---|---|---|---|
| Bloom's Level | Continuous Assessment | | | | End Semester Examination (Theory) [40 marks] |
| | Theory | | | Practical& Project | |
| | CIA-I [10 marks] | CIA-II [10 marks] | CIA-III [10 marks] | Rubric based CIA [30 Marks] | |
| Remember | 20 | 20 | 20 | 20 | 20 |
| Understand | 30 | 30 | 30 | 30 | 30 |
| Apply | 50 | 50 | 50 | 50 | 50 |
| Analyse | - | - | - | - | - |
| Evaluate | - | - | - | - | - |
| Create | - | - | - | - | - |

| 20EN101 | TECHNICAL COMMUNICATION SKILLS (MECH/MCT/IT/CIVIL/CSE) | 2/0/2/3 |
|---|---|---|
| | | |
| **Nature of Course** | :E(Theory Skill Based) | |
| **Pre requisites** | Basics of English Language | |
| **Course Objectives:** | | |
| 1 | To enhance learners' LSRW skills. | |
| 2 | To develop effective communication skills. | |
| 3 | To facilitate learners to acquire effective technical writing skills. | |
| 4 | To prepare learners for placement and competitive exams. | |
| 5 | To facilitate effective language skills for academic purposes and real-life situations. | |
| **Course Outcomes:**<br>**Upon completion of the course, students shall have ability to** | | |
| C101.1 | Remember language skills for technical communication. | [R] |
| C101.2 | Apply communication skills in corporate environment. | [AP] |
| C101.3 | Understand and communicate effectively in personal and professional situation. | [AP] |
| C101.4 | Understand and analyse a variety of reading strategies to foster comprehension and to construct meaningful and relevant connections to the text. | [U] |
| C101.5 | Apply technical writing skills to write letters, emails and prepare technical documents. | [AP] |
| C101.6 | Apply language skills with ease in academic and real-life situations. | [AP] |

**Course Contents:**

**Listening and Speaking** **17 Hours**

Introduction to Effective Communication- Basics of English Language - Importance of LSRW Skills - Self Introduction - Introducing Others - **Listening** to Short Conversations or Monologues - Listening to Speeches / Talks - Listening and Responding -- Longer Listening Tasks -Recognise Functions **Speaking**- Speaking about Giving Directions / Instruction - Talk about Preferences-Agree and Disagree - Giving Opinions - Speaking Practices by Giving Examples, Reasons and Additional Information- Short Talk on Business Topics- Non Verbal Communication- Presentation using Digital Tools- Effectiveness of Narration- Leadership, Conflict and Persuasion.

**Reading** **13 Hours**

Reading Short Texts - Skimming and Scanning - Comparing Facts and Figures - Reading and Understanding Specific Information in a Text - Cloze Reading - Identifying Reasons and Consequences Through Reading Practices - Comprehension - Collocations.

**Grammar and Writing** **15 Hours**

Parts of Speech- Tenses – Subject Verb Agreement - Sentence Structures - Connectives - Modal Verbs - Question Formation - If Conditionals- Active and Passive - Impersonal Passive Voice - Vocabulary Building - Business Vocabulary -- Synonyms, Antonyms – British and American Words - One Word Substitution- Identifying Common Errors.

Writing Formal Letters (Accepting and Declining Invitations) - Writing Business Letters (Calling for Quotation, Seeking Clarification, Placing an Order and Complaint Letter) - Email Writing – Memo - Circular - Agenda and Minutes of the Meeting - Job Application Letter - Resume Writing - Paragraph Writing – Proof Reading and Editing--Technical Instructions and Recommendations- Jumbled Sentences - Technical Definitions - Report Phrases - Report Writing - Technical Proposal - Transcoding (Bar Chart, Flow Chart).

| **Lab Components** | | |
|---|---|---|
| 1 | Listening Comprehension | [E] |
| 2 | Pronunciation, Intonation, Stress and Rhythm | [E] |
| 3 | Situational Dialogues | [E] |
| 4 | Formal Presentation | [E] |
| 5 | Group Discussion | [E] |
| 6 | Interview Skills- Online and Offline | [E] |
| | **Total Hours:** | **60** |

| **Text Books:** | |
|---|---|
| 1 | Practical English Usage. Michael Swan. OUP. 1995. |
| 2 | Remedial English Grammar. F.T. Wood. Macmillan.2007 |
| 3 | On Writing Well. William Zinsser. Harper Resource Book. 2001 |
| 4 | Dr Sumanth S, English for Engineers, Vijay Nicole Imprints Private Limited 2015. |
| **Reference Books:** | |
| 1 | Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006. |
| 2 | Communication Skills. Sanjay Kumar and Pushp Lata. Oxford University Press. 2011. |
| 3 | Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press |
| **Web References:** | |
| 1 | http://www.academiccourses.com/Courses/English/Business-English |
| 2 | https://**steptest**.in |
| **Online Resources:** | |
| 1 | https://www.coursera.org/specializations/business-english |
| 2 | http://www.academiccourses.com/Courses/English/Business-English |
| 3 | https://scoop.eduncle.com/one-word-substitution-list |

| 20PH103 | PHYSICS FOR COMPUTING SCIENCE (Common to CSE, IT and AI&DS) | 3/0/3/4.5 |
|---|---|---|

| | |
|---|---|
| Nature of Course | : E (Theory skillbased) |
| Prerequisites | : Nil |

Course Objectives:

| | |
|---|---|
| 1. | To learn the fundamental concepts of physics and apply this knowledge to both scientific and engineering problems. |
| 2. | To make the students enrich basic knowledge in various fields such as Laser, Optical fibers, Photonics, Superconductors and quantum mechanics of physics and apply the same in computing fields. |

Course Outcomes:
Upon completion of the course, students shall have the ability to

| | | |
|---|---|---|
| C103.1 | Recall and interpretthe basic concepts of lasers and various types of optical fibers for articulating in engineering applications. | [R] |
| C103.2 | Describe and conduct experiments in photonic materials. | [U] |
| C103.3 | Acquire basic understanding and fundamental concepts of superconductors. | [R] |
| C103.4 | Discuss the dual nature of radiation and matter. | [U] |
| C103.5 | Solve Schrodinger's equations on finite and infinite potential well problems. | [Ap] |
| C103.6 | Apply quantum idea for understanding the working of quantum computing. | [AP] |

**Course Contents:**

**Laser and Fiber optics15 Hours**

***Laser:***Characteristics of laser – Principle of spontaneous emission and stimulated emission – Einstein's theory of matter radiation interaction and A and B coefficients (derivation) – Population inversion – Pumping –Nd-YAG and $CO_2$ laser – Applications: Laser printer, Data storage and Bar code scanner.***Fiber optics:***Light propagation through fibers, acceptance angle, numerical aperture –Types of fibers: stepindex, graded index, single mode and multimode– Optical fibers for computing applications–PC to PC communication and fiber optics in computer networking.

**Photonics and Superconductors15 Hours**

***Photonics:*** Introduction to photonic materials – Photonic crystals – Liquid crystal display (LCD) Light sources: Light emitting diode (LED) –Photo dependence resistor– Photo detectors: PIN, avalanche – Photo voltaic effect, Solar cell – Applications of photonic materials in computing – optical computing.***Superconductors:***Properties of Superconductors: effect of magnetic field, Meissner effect,effect of current,thermal properties,isotope effect, Josephson effects and its applications – Type–I and Type–II Superconductors –BCS theory–High $T_C$ superconductors – Application of Superconductors: magnetic levitation, SQUID and cryotron.

**Quantum Mechanics and Quantum computing15 Hours**

***Quantum Mechanics:***Planck's quantum theory (derivation) – Matter waves, de-Broglie wavelength, Heisenberg's uncertainty principle –Schrödinger's wave equation: time independent and time dependent –Physical significance of wave function –Particle in a one dimensional potential box– Electron microscope: SEM and TEM–Postulates of quantum mechanics. ***Quantum computing***:Introduction to quantum computing–qubits, entanglement, decoherence and quantum supermacy,differences in quantum and classicalcomputation.

.

| **Lab Component** | | **30 Hours** |
|---|---|---|
| 1 | Particle size determination and measurement of d-spacing in CD using Laser. | [U] |
| 2 | Determination of wavelength, angle of divergence and coherence length | [U] |

| | | |
|---|---|---|
| | of laser source. | |
| 3 | Determination of numerical aperture and acceptance angle parameter of optical fiber using Laser source. | [U] |
| 4 | Characteristics curves of solar cell. | [U] |
| 5 | Characteristics curve of light dependent resistor (LDR). | [U] |
| 6 | Determination of bandgap of semiconductor. | [U] |
| 7 | Determination and verification of Stefan law. | [U] |
| 8 | Determination of Planck's constant using electroluminescence. | [U] |
| 9 | Determination of entangled photons using spectrometer. | [U] |
| 10 | Determination of wavelength of mercury spectrum – Spectrometer | [U] |
| | **Life Skills Experiments** | |
| 1 | How does a fuel (gas/liquid) pump nozzle shut off? | |
| 2 | How does a circuit breaker work? | |
| 3 | How to Check Earthing at Home? | |
| | Total Hours: | 75 |
| Text Books: | | |
| 1 | Rajendran, V "Engineering Physics" Mc Graw Hill Publications ltd, New Delhi, 2016. | |
| 2 | David Halliday, Robert Resnick, Jearl Walker "Fundamentals of Physics", 11th edition, Wiley, 2018. | |
| 3 | Eleanor Rleffel and Wolfgang Polak, "Quantum computing a gentle introduction", 1st edition,The MIT press, 2012. | |
| Reference Books: | | |
| 1 | William T. Silfvast "Laser Fundamentals" Cambridge University Press, 2012 | |
| 2 | FedorMitschke "Fiber Optics physics and Technology", 2nd edition, Springer, 2017. | |
| 3 | Chakrabarti P. "Optical Fiber Communication", McGraw Hill Education,2015. | |
| 4 | Kasap,Safa, Capper, "Handbook of Electronic and Photonic Materials" 2nd edition, Springer, 2017. | |
| 5 | Balkan, Naci, Erol, Ayşe, "Semiconductors for Optoelectronics", 1st edition Springer, 2020. | |
| 6 | Bhattacharya D. K. and Poonam Tandon, "Engineering Physics", Oxford University press, 2014 | |
| 7 | David J. Griffiths, "Introduction to Quantum Mechanics", 2nd edition , Cambridge university press, 2017. | |
| 8 | Chris Bernhardt, "Quantum Computing for Everyone" The MIT press, 2019 | |

**20AD201** **Data Structures using C** **3/0/2/4**

**Nature of Course** : F (Theory Programming)
**Pre requisites** : Fundamentals of Problem Solving

**Course Objectives:**

1. To learn the features of C
2. To handle functions, pointers, structures, unions and files using C
3. To manipulate linear and non-linear data structures
4. To explore the applications of linear and non-linear data structures
5. To familiarize the concepts of hashing.

**Course Outcomes:**

**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C201.1 | Develop C programs for any real world technical application using basic programming construct, arrays and strings | [AP] |
| C201.2 | Apply advanced features of C in solving problems | [AP] |
| C201.3 | Design applications using sequential and random access file processing | [AP] |
| C201.4 | Demonstrate operations like insertion, deletion, searching, traversing etc. on linear and non-linear data structures | [AP] |
| C201.5 | Apply appropriate hash functions that result in a collision free scenario for data storage and retrieval. | [AP] |
| C201.6 | Choose appropriate data structure for any real world data set. | [A] |

**Course Contents:**

**MODULE I C PROGRAMMING - 15 Hours**

**Basic Features:** Introduction -Data Types – Variables – Operations – Expressions and Statements – Conditional and Iterative Statements – Functions – Recursive Functions – Arrays – Single and Multi-Dimensional Arrays- Strings.

**Advanced Features:** Structures – Union – Enumerated Data Types – Pointers: Pointers to Variables, Arrays and Functions – File Handling – Storage classes - Preprocessor Directives.

**MODULE II LINEAR DATA STRUCTURES – LIST, STACK, QUEUE - 15 Hours**

Abstract Data Types (ADTs) – List ADT – Array based implementation – Linked list implementation – Singly linked lists – Circularly linked lists – Doubly linked lists – Application of lists – Polynomial Manipulation. Stack ADT – Operations – Applications – Evaluating arithmetic expressions – Conversion of Infix to postfix expression – Queue ADT – Operations – Circular Queue – Priority Queue – Applications of queues.

**MODULE III NON-LINEAR DATA STRUCTURES 15 Hours**

Trees – Binary Trees – Tree Traversals – Expression Trees – Binary Search Tree – Graphs- Breadth First traversal - Depth- first traversal- Hashing - Hash Functions – Separate Chaining – Open Addressing – Linear Probing– Quadratic Probing – Double Hashing – Rehashing.

**Total Hours: 45**

**Lab Exercises**

1. Practice of C Programming using Branching and Iterative constructs.
2. Programs using Functions and Arrays
3. Programs using Structures and Pointers.
4. Implementation of Stack using Arrays
5. Implementation of Stack using Linked List.

6. Implementation of Queue using Arrays
7. Implementation of Queue using Linked List.
8. Implementation of Binary Search Tree.
9. Implementation of hashing techniques

**Total Hours: 15**

**Text Books:**


1. YashavantKanetkar, “Let us C”, 15th Edition, BPB Publications, 2017
2. ReemaThareja, “Programming in C”, 2nd Edition, Oxford University Press, 2016.
3. PradipDey and ManasGhosh, “Programming in C”, 2nd Edition, Oxford University Press, 2011.
4. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C”, Pearson Education India, 3rd Edition 2013.


**Reference Books:**


1. Ellis Horowitz, SartajSahni, Susan Anderson-Freed, “Fundamentals of Data Structures in C”, 2nd Edition, University Press, 2008
2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, “Data Structures and Algorithms”, Pearson Education, 1983.
3. Robert Kruse, C.L.Tondo, Bruce Leung, ShashiMogalla , “Data Structures and Program Design in C”, 2nd Edition, Pearson Education, 2007
4. Jean-Paul Tremblay and Paul G. Sorenson, “An Introduction to Data Structures with Applications”, 2nd Edition, Tata McGraw-Hill, 1991.
5. Seymour Lipschutz, “ Data Structures by Schaum series”, 2nd Edition, Tata McGraw Hill, 2013.


**Web References:**

1. http://www.nptel.ac.in
2. https://visualgo.net/en

**Online Resources:**

1. https://www.youtube.com/watch?v=-CpG3oATGIs
2. http://lcm.csa.iisc.ernet.in/dsa/dsa.html
3. http://utubersity.com/?page_id=878
4. http://freevideolectures.com/Course/2519/C-Programming-and-Data-Structures
5. http://freevideolectures.com/Course/2279/Data-Structures-And-Algorithms

| **Assessment Methods & Levels (based on Blooms’ Taxonomy)** | | | |
|---|---|---|---|
| **Summative assessment based on Continuous and End Semester Examination** | | | |
| | **Continuous Assessment** | | **End Semester** |
| | **Theory** | **Practical** | |

| Bloom's Level | CIA1 [10 Marks] | CIA2 [10 marks] | CIA3 [10 marks] | Rubric based CIA [30 Marks] | Examination (Theory) [40 marks] |
|---|---|---|---|---|---|
| Remember | - | - | - | - | - |
| Understand | 50 | 10 | 20 | - | 10 |
| Apply | 50 | 50 | 40 | 30 | 50 |
| Analyze | - | 40 | 40 | 20 | 40 |
| Evaluate | - | - | - | 20 | - |
| Create | - | - | - | 30 | - |

**Mapping of Course Outcomes (CO) with Programme Outcomes (PO) Programme Specific Outcomes (PSO)**

| COs | Pos | | | | | | | | | | | | PSOs | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | a | b | c | d | e | f | g | h | i | j | k | l | 1 | 2 | 3 |
| C201.1 | 3 | 3 | 1 | 1 | 2 | | | | | | | | 3 | 1 | 2 |
| C201.2 | 3 | 3 | 2 | 1 | 1 | | | | | | | | 3 | 1 | 2 |
| C201.3 | 3 | 3 | 1 | 2 | 1 | | | | | | | | 3 | 2 | 3 |
| C201.4 | 3 | 3 | 3 | 3 | 2 | | | | | | | | 3 | 1 | 1 |
| C201.5 | 3 | 3 | 3 | 3 | 2 | | | | | | | | 3 | 1 | 1 |
| C201.6 | 3 | 3 | 3 | 3 | 2 | | | | | | | | 3 | 1 | 1 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 3 | Strongly agreed | 2 | Moderately agreed | 1 | Weakly agreed | |

| 20ME111 | ENGINEERING GRAPHICS | 1/0/3/2.5 |
|---|---|---|
| **Nature of Course** | Practical application | |
| **Pre Requisites** | Basic Drawing and Computer Knowledge | |

**Course Objectives:**

| | |
|---|---|
| 1 | To know the method to construct the conic curves used in engineering applications. |
| 2 | To develop an understanding of Isometric to orthographic views and vice versa. |
| 3 | To learn the basic projection of straight lines and plane surfaces. |
| 4 | To develop the imagination of solids inclined to one reference plane. |
| 5 | To know the development of surfaces used in various fields. |

**Course Outcomes:**
**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C111.1 | Understand the basic concepts of Engineering Graphics. | [U] |
| C111.2 | Sketch isometric, orthographic projections and projection of lines and planes | [Ap] |
| C111.3 | Develop lateral surfaces of solids including prisms and pyramids | [Ap] |
| C111.4 | Construct projections of lines, planes, solids and isometric views using modelling software. | [A] |

**Course Contents:**

Conic curves and special curves – Isometric projections, Isometric to orthographic projection-Orthographic to Isometric projection-Projection of lines and plane surfaces-Projection of solids-Development of surfaces-Introduction to perspective projection.

| S.No | List of Experiments | CO Mapping | RBT |
|---|---|---|---|
| 1 | Introduction to drafting software. | C111.1 | U |
| 2 | Construction of conic curves (Ellipse, Parabola and Hyperbola) | C111.1 | U |

| | | | |
|---|---|---|---|
| 3 | Construction of special curves (Cycloid and Involutes) | C111.1 | U |
| 4 | Isometric to orthographic projections – manual sketches | C111.2 | Ap |
| 5 | Isometric to orthographic projections – software sketches | C111.4 | A |
| 6 | Projection of lines - inclined to HP, VP and Both HP & VP | C111.4 | A |
| 7 | Projection of plane surfaces (Hexagon, Pentagon and circle) – inclined to any one of the principle planes | C111.4 | A |
| 8 | Projection of solids (Prism and Pyramid) – inclined to HP | C111.3 | Ap |
| 9 | Projection of solids (Cone and Cylinder) – inclined to VP | C111.3 | Ap |
| 10 | Development of surfaces (Prism, Pyramid, Cone and Cylinder) | C111.4 | A |
| 11 | Introduction to perspective projection | C111.2 | U |
| | | **Total Hours:** | **45** |

**Reference Books:**


| | |
|---|---|
| 1 | Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 50th Edition, 2014. |
| 2 | K. V. Natarajan, "A Text Book of Engineering Graphics", Dhanalakshmi Publishers, 2018. |
| 3 | Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Stores, Bangalore, 2011. |
| 4 | Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2013. |


**Web References:**

| | |
|---|---|
| 1 | http://nptel.ac.in/courses/112102101/ |
| 2 | www.solidworks.com |

| **20MC201** | **ENVIRONMENTAL SCIENCES** | **2 /0 /0 /0** |
|---|---|---|

| | |
|---|---|
| **Nature of Course** | :C (Theory Concept) |
| **Pre requisites** | :Basics in Environmental Studies |

**Course Objectives:**

| | |
|---|---|
| 1<br>2<br>3 | To learn the integrated themes on various natural resources.<br>To gain knowledge on the type of pollution and its control methods.<br>To have an awareness about the current environmental issues and the social problems. |

**Course Outcomes:**
**Upon completion of the course, students shall have ability to**

| | | |
|---|---|---|
| C201.1 | Recall and play an important role in transferring a healthy environment for future generation. | [R] |
| C201.2 | Understand the importance of natural resources and conservation of biodiversity. | [U] |
| C201.3 | Understand and analyze the impact of engineering solutions in a global and societal context. | [U] |
| C201.4 | Apply the gained knowledge to overcome pollution problems. | [AP] |
| C201.5 | Apply the gained knowledge in various environmental issues and sustainable development. | [AP] |

**Course Contents:**

**Natural Resources:**

Introduction-Forest resources: Use and abuse, case study-Major activities in forest-Water resources-over utilization of water, dams-benefits and problems. Mineral resources-Use and exploitation, environmental effects of mining- case study–Food resources- World food problems, case study. Energy resources -Renewable and non-renewable energy sources Land resources-

Soil erosion and desertification – Role of an individual in conservation of natural resources.

**Environmental Pollutions:**

Definition – causes, effects and control measures of: a. Air pollution-Acid rain - Green house effect-Global warming- Ozone layer depletion – case study- Bhopal gas tragedyb. Water pollution c. Solid waste management-Recycling of plastics-Pyrolysis method- causes, effects and control measures of municipal solid wastes d. Noise pollution. e. Nuclear hazards-case study-Chernobyl nuclear disaster-Role of an individual in prevention of pollution.

**Social issues and the Environment:**

Sustainable development-water conservation, rain water harvesting, E-Waste Management – Environmental ethics: 12 Principles of green chemistry-Scheme of labelling of environmental friendly products (Eco mark) – Emission standards – ISO 14001 standard. HIV AIDS.

| | **Total Hours:** | **30** |
|---|---|---|

**Text Books:**

| | |
|---|---|
| 1 | AnubhaKaushik and C P Kaushik "Perspectives in Environmental Studies"4th Edition, Newage International (P) Limited, Publisher Reprint 2014. New Delhi |
| 2 | Rajagopalan, R, "Environmental Studies-From Crisis to Cure", Oxford University Press 2015. |

**Reference Books:**

| | |
|---|---|
| 1 | Tyler Miller, Jr., "Environmental Science", Brooks/Cole a part of Cengage Learning, 2014. |
| 2 | William Cunningham and Mary Cunningham, "Environmental Science", 13th Edition, McGraw Hill,2015. |
| 3 | Gilbert M. Masters, "Introduction to Environmental Engineering and Science", Third Edition, Pearson Education, 2014. |

**Web References:**

| | |
|---|---|
| 1 | http://nptel.ac.in/courses/104103020/20 |
| 2 | http://nptel.ac.in/courses/120108002 |
| 3 | http://nptel.ac.in/courses/122106030 |
| 4 | http://nptel.ac.in/courses/120108004/ |
| 5 | http://nptel.ac.in/courses/122102006/20 |

**Online Resources:**

| | |
|---|---|
| 1 | https://www.edx.org/course/subject/environmental-studies |
| 2 | www.environmentalscience.org |

**Assessment Methods & Levels (based on Bloom's Taxonomy)**

**Formative assessment based on Capstone Model (Max. Marks:40)**

| Course Outcome | Bloom's Level | Assessment Component | Marks |
|---|---|---|---|
| C201.1 | Remember | Quiz | **5** |
| C201.2 | Understand | Mini project based on environmental aspect | **15** |
| C201.3 | Understand | Class Presentation | **10** |
| C201.4 | Apply | Group Assignment | **10** |

**Summative assessment based on Continuous Assessment**

| Bloom's Level | Continuous Assessment | | |
|---|---|---|---|
| | CIA-I [0 marks] | CIA-II [0 marks] | Term End Assessment [60 marks] |
| Remember | - | - | 30 |
| Understand | - | - | 40 |
| Apply | - | - | 30 |
| Analyse | - | - | - |
| Evaluate | - | - | - |
| Create | - | - | - |