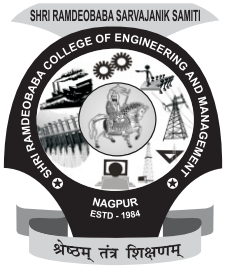


# SHRI RAMDEOBABA COLLEGE OF ENGINEERING AND MANAGEMENT, NAGPUR – 440013

An Autonomous College affiliated to
Rashtrasant Tukadoji Maharaj Nagpur University,
Nagpur, Maharashtra (INDIA)

## PROGRAMME SCHEME & SYLLABI
## 2021 – 2022

## B.Tech. COMPUTER SCIENCE & ENGINEERING (DATA SCIENCE)

Published By

**Dr. R. S. Pande**

Principal
Shri Ramdeobaba College of Engineering & Management
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ISO 9001 : 2015 CERTIFIED ORGANISATION

## About The Department

The Department of Computer Science & Engineering was established in 2002, is well-equipped with state-of-the-art infrastructure. The state of art infrastructure includes latest configuration desktops organized in four different laboratories. There are total 170 desktops with internet facility and interconnected by a 24 hours server and CISCO router. The department hosts 300 computers with internet facility. The 24X7 network managed with Cyberoam UTM firewall, and CISCO router offers intranet and internet connectivity. The computer laboratories have high-end servers of IBM and WIPRO along with industry-standard software, viz., Oracle, NetSim, Wireshark, AIX, Robotics Platform, IOT Kit and MSDN. The department promotes high-end computing through Open Source technologies and hosts NVIDIA DGX DL Workstation.

The Department has a distinction of consistently achieving above 95% results in the final year. Students are encouraged to appear in GATE, CAT, GRE and other competitive examinations which have resulted in increasing number of students clearing these exams. Students teams of CSE have emerged winners at the Grand Finale of 2018, 2019 and 2020 editions of Smart India Hackthoan and have been excelling at the world renowned prestigious International Collegiate Programming Contest, ACM ICPC Asia West Regional Contents since 2015.

## Department Vision

To continually improve the education environment, in order to develop graduates with strong academic and technical background needed to achieve distinction in the discipline. The excellence is expected in various domains like workforce, higher studies or lifelong learning. To strengthen links between industry through partnership and collaborative development works.

## Department Mission

To develop strong foundation of theory and practices of computer science amongst the students to enable them to develop into knowledgeable, responsible professionals, lifelong learners and implement the latest computing technologies for the betterment of the society.

## Programme Outcomes (POs):

1. **Engineering knowledge :** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **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.
3. **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.

4. **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.

5. **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.

6. **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.

7. **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.

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

9. **Individual and team work :** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **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.

11. **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.

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

# Scheme for B. E. Computer Science and Engineering (Data Science)

## Semester - I

| Sr. No. | Category | Course code | Course Name | Hours/week | | | Credits | Maximum marks | | | ESE Duration (Hrs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | Continuous Evaluation | End Sem Exam | Total | |
| 1. | BSC | CHT152 | Chemistry | 3 | 1 | 0 | 4 | 40 | 60 | 100 | 03 |
| 2. | BSC | CHP152 | Chemistry Lab | 0 | 0 | 3 | 1.5 | 25 | 25 | 50 | - |
| 3. | BSC | MAT152 | Differential Equation, Linear Algebra, Statistics & Probability | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 03 |
| 4. | PCC | CDT101 | Programming for Problem Solving | 4 | 0 | 0 | 4 | 40 | 60 | 100 | 03 |
| 5. | PCC | CDP101 | Programming for Problem Solving Lab | 0 | 0 | 2 | 1 | 25 | 25 | 50 | - |
| 6. | ESC | IDT151 | Creativity, Innovation & Design Thinking | 1 | 0 | 0 | 1 | 20 | 30 | 50 | 1.5 |
| 7. | ESC | CDT102 | Computer Workshop | 1 | 0 | 0 | 1 | 20 | 30 | 50 | 1.5 |
| 8. | ESC | CDP102 | Computer Workshop Lab | 0 | 0 | 2 | 1 | 25 | 25 | 50 | - |
| 9. | HSMC | HUT151 | English | 2 | 0 | 0 | 2 | 40 | 60 | 100 | 03 |
| 10. | HSMC | HUP151 | English Lab | 0 | 0 | 2 | 1 | 25 | 25 | 50 | - |
| | | | **TOTAL** | **14** | **1** | **9** | **19.5** | | | **700** | |

## Semester - II

| Sr. No. | Category | Course code | Course Name | Hours/week | | | Credits | Maximum marks | | | ESE Duration (Hrs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | Continuous Evaluation | End Sem Exam | Total | |
| 1. | BSC | PHT156 | Semiconductor Physics | 3 | 1 | 0 | 4 | 40 | 60 | 100 | 03 |
| 2. | BSC | PHP156 | Semiconductor Physics Lab | 0 | 0 | 3 | 1.5 | 25 | 25 | 50 | - |
| 3. | BSC | MAT151 | Calculus | 3 | 1 | 0 | 4 | 40 | 60 | 100 | 03 |
| 4. | BSC | MAP151 | Computational Mathematics Lab | 0 | 0 | 2 | 1 | 25 | 25 | 50 | - |
| 5. | ESC | CDT103 | Digital Electronics | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 03 |
| 6. | ESC | CDP103 | Digital Electronics Lab | 0 | 0 | 2 | 1 | 25 | 25 | 50 | - |
| 7. | PCC | CDT104 | Object Oriented Programming | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 03 |
| 8. | PCC | CDP104 | Object Oriented Programming Lab | 0 | 0 | 2 | 1 | 25 | 25 | 50 | - |
| 9. | HSMC | HUT152 | Constitution of India | 2 | 0 | 0 | 0 | - | - | - | - |
| 10. | MC | PEP151 | Yoga / Sports | 0 | 0 | 2 | 0 | - | - | - | - |
| | | | **TOTAL** | **14** | **2** | **11** | **18.5** | | | **600** | |

## Semester-III

| Sr. No. | Category | Course Code | Course Name | Hours/week | | | Credits | Maximum marks | | | ESE Duration (Hrs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | Continuous Evaluation | End Sem Exam | Total | |
| 1. | BSC | MAT272 | Mathematics for Data Science | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 03 Hrs |
| 2. | PCC | CDT201 | Data Structure and Algorithms | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 03 Hrs |
| 3. | PCC | CDP201 | Data Structure and Algorithms Lab | 0 | 0 | 4 | 2 | 25 | 25 | 50 | - |
| 4. | PCC | CDT202 | Computer Organization and Architecture | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 03 Hrs |
| 5. | PCC | CDP203 | Advanced Object Oriented Programming Lab | 0 | 0 | 4 | 2 | 25 | 25 | 50 | - |
| 6. | PCC | CDP204 | Technical Skill Enhancement Lab | 0 | 0 | 2 | 1 | 25 | 25 | 50 | - |
| 7. | PCC | CDP205 | Statistical Programming Lab | 0 | 0 | 2 | 1 | 25 | 25 | 50 | - |
| 8. | HSMC | HUT256 | Indian Traditional Knowledge | 2 | 0 | 0 | 0 | - | - | - | - |
| 9. | HSMC | HUT253 | Business Communications | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 03 Hrs |
| 10. | HSMC | HUT257 | Cyber Laws & Ethics in IT | 2 | 0 | 0 | 2 | 40 | 60 | 100 | 03 Hrs |
| | | | **TOTAL** | **15** | **1** | **12** | **20** | | | **700** | - |

## Semester-IV

| Sr. No. | Category | Course Code | Course Name | Hours/week | | | Credits | Maximum marks | | | ESE Duration (Hrs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | Continuous Evaluation | End Sem Exam | Total | |
| 1. | PCC | CDT206 | Artificial Intelligence | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 03 Hrs |
| 2. | PCC | CDT207 | Operating Systems | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 03 Hrs |
| 3. | PCC | CDP207 | Operating Systems Lab | 0 | 0 | 4 | 2 | 25 | 25 | 50 | - |
| 4. | PCC | CDT208 | Database Management Systems | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 03 Hrs |
| 5. | PCC | CDP208 | Database Management Systems Lab | 0 | 0 | 4 | 2 | 25 | 25 | 50 | - |
| 6. | PCC | CDT209 | Theory of Computation | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 03 Hrs |
| 7. | PCC | CDT210 | Computer Network | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 03 Hrs |
| 8. | PCC | CDP211 | Data Handling and Visualization Lab | 0 | 0 | 4 | 2 | 25 | 25 | 50 | - |
| 9. | OEC | | Open Elective - 1 | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 03 Hrs |
| 10. | MC | CHT252 | Environmental Sciences | 2 | 0 | 0 | 0 | - | - | - | - |
| | | | **TOTAL** | **20** | **0** | **12** | **24** | | | **750** | - |

| | Recommended Course from MOOC |
|---|---|
| 1 | Model Thinking |

## Semester-V

| Sr. No. | Category | Course Code | Course Name | Hours/week | | | Credits | Maximum marks | | | ESE Duration (Hrs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | Conti-nuous Evaluation | End Sem Exam | Total | |
| 1. | PCC | CDT301 | Machine Learning | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 03 Hrs |
| 2. | PCC | CDP301 | Machine Learning Lab | 0 | 0 | 2 | 1 | 25 | 25 | 50 | - |
| 3. | PCC | CDT302 | Information Security and Privacy | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 3Hrs |
| 4. | PCC | CDP303 | Programming Languages Lab | 0 | 0 | 4 | 2 | 25 | 25 | 50 | - |
| 5. | PCC | CDT304 | Compiler Design | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 03 Hrs |
| 6. | PEC | CDT305 | Program Elective - I | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 03 Hrs |
| 7. | PEC | CDP305 | Program Elective – I Lab | 0 | 0 | 2 | 1 | 25 | 25 | 50 | - |
| 8. | PR | CDP306 | Project Based Learning - I | 0 | 0 | 6 | 3 | 25 | 25 | 50 | - |
| 9. | OEC | | Open Elective-II / MOOC | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 03 Hrs |
| | | | **TOTAL** | **15** | **0** | **14** | **22** | | | **700** | - |

| Course Code | Program Elective – I |
|---|---|
| CDT305-1 | Digital Image Processing |
| CDT305-2 | Language Processor |
| CDT305-3 | Design Patterns |
| CDT305-4 | Health Informatics |

| Course Code | Program Elective – I Lab |
|---|---|
| CDP305-1 | Digital Image Processing Lab |
| CDP305-2 | Language Processor Lab |
| CDP305-3 | Design Patterns Lab |
| CDP305-4 | Health Informatics Lab |

| | Recommended course from MOOC |
|---|---|
| 1 | Android Programming |

## Semester-VI

| Sr. No. | Category | Course Code | Course Name | Hours/week | | | Credits | Maximum marks | | | ESE Duration (Hrs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | Conti-nuous Evaluation | End Sem Exam | Total | |
| 1. | PCC | CDT307 | Design and Analysis of Algorithm | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 3Hrs |
| 2. | PCC | CDT308 | Deep Learning - I | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 3Hrs |
| 3. | PCC | CDP308 | Deep Learning – I Lab | 0 | 0 | 4 | 2 | 25 | 25 | 50 | - |
| 4. | PEC | CDT309 | Program Elective - II | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 3Hrs |
| 5. | PEC | CDP309 | Program Elective – II Lab | 0 | 0 | 2 | 1 | 25 | 25 | 50 | - |
| 6. | PCC | CDT310 | Software Engineering and Testing Methodologies | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 3Hrs |
| 7. | PCC | CDP310 | Software Engineering and Testing Methodologies Lab | 0 | 0 | 2 | 1 | 25 | 25 | 50 | - |
| 8. | PR | CDP311 | Project Based Learning - II | 0 | 0 | 6 | 3 | 25 | 25 | 50 | - |
| 9. | OEC | | Open Elective-III / MOOC | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 3Hrs |
| | | | **TOTAL** | 15 | 0 | 14 | 22 | | | 700 | - |

| Course Code | Program Elective – II |
|---|---|
| CDT309-1 | Computer Vision |
| CDT309-2 | Natural Language Processing |
| CDT309-3 | IOT systems and cloud |
| CDT309-4 | Data Science for Healthcare |

| Course Code | Program Elective – II Lab |
|---|---|
| CDP309-1 | Computer Vision Lab |
| CDP309-2 | Natural Language Processing Lab |
| CDP309-3 | IOT systems and cloud Lab |
| CDP309-4 | Data Science for Healthcare Lab |

| | Recommended course from MOOC |
|---|---|
| 1 | Business Analytics |

## Semester-VII

| Sr. No. | Category | Course Code | Course Name | Hours/week | | | Credits | Maximum marks | | | ESE Duration (Hrs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | Continuous Evaluation | End Sem Exam | Total | |
| 1. | PCC | CDT401 | Deep Learning - II | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 3Hrs |
| 2. | PCC | CDP401 | Deep Learning – II Lab | 0 | 0 | 4 | 2 | 25 | 25 | 50 | -- |
| 3. | PCC | CDT402 | Large Scale Data Analytics | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 3Hrs |
| 4. | PEC | CDT403 | Program Elective-III | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 3Hrs |
| 5. | PEC | CDP403 | Program Elective-III Lab | 0 | 0 | 2 | 1 | 25 | 25 | 50 | -- |
| 6. | PEC | CDT404 | Program Elective-IV | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 3Hrs |
| 7. | PEC | CDP404 | Program Elective-IV Lab | 0 | 0 | 2 | 1 | 25 | 25 | 50 | -- |
| 8. | OEC | | Open Elective-IV / MOOC | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 3Hrs |
| 9. | PR | CDP405 | Project Based Learning – III | 0 | 0 | 6 | 3 | 40 | 60 | 100 | 3Hrs |
| | | | **TOTAL** | **15** | **0** | **14** | **22** | | | **750** | - |

| Course Code | Program Elective – III | Course Code | Program Elective – IV |
|---|---|---|---|
| CDT403-1 | Convolutional Neural Networks for Visual Recognition | CDT404-1 | Graph Mining |
| CDT403-2 | Recurrent Neural Networks for NLP | CDT404-2 | Data Science for NLP |
| CDT403-3 | Dockers and Kubernetes | CDT404-3 | High Performance Computing |

| Course Code | Program Elective – III Lab | Course Code | Program Elective – IV Lab |
|---|---|---|---|
| CDP403-1 | Convolutional Neural Networks for Visual Recognition Lab | CDP404-1 | Graph Mining Lab |
| CDP403-2 | Recurrent Neural Networks for NLP Lab | CDP404-2 | Data Science for NLP Lab |
| CDP403-3 | Dockers and Kubernetes Lab | CDP404-3 | High Performance Computing Lab |

| | Recommended course from MOOC |
|---|---|
| 1 | Human Computer Interaction |
| 2 | Robotics |

## Semester-VIII

| Sr. No. | Category | Course Code | Course Name | Hours/week | | | Credits | Maximum marks | | | ESE Duration (Hrs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | | Continuous Evaluation | End Sem Exam | Total | |
| 1. | PEC | CDT406 | Program Elective-V | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 3Hrs |
| 2. | PEC | CDT407 | Program Elective-VI | 3 | 0 | 0 | 3 | 40 | 60 | 100 | 3Hrs |
| 3. | PR | CDP408 | Project Based Learning - IV | 0 | 0 | 12 | 6 | 50 | 50 | 100 | - |
| | | | **OR** | | | | | | | | |
| 4. | PR | CDP409 | Industry Internship | - | - | - | 12 | 150 | 150 | 300 | - |
| | | | **TOTAL** | 6 | 0 | 12 | 12 | | | | |

| Course Code | Program Elective – V | Course Code | Program Elective – VI |
|---|---|---|---|
| CDT406-1 | Information Retrieval | CDT407-1 | Time Series Analysis |
| CDT406-2 | Advanced Multi-Core Systems | CDT407-2 | Social and Information Network Analysis |
| CDT406-3 | Mining Massive Data Sets | CDT407-3 | Biomedical Image and Signal Processing |

**Total Credits = 160**

## Syllabus for Semester I, BE Computer Science & Engineering (Data Science)

**Course Code : CHT152** **Course : Chemistry**

**L: 3 Hrs, T: 1 Hr, P: 0 Hr, Per Week** **Total Credits : 4**

### Course Outcomes

After the successful completion of the course, students shall be able to

- Predict the properties and interactions of chemical substances by understanding their composition at the atomic level.
- Conversant in applying unique properties of nano-materials to solve challenges in our life.
- Explain the differences in the mechanical behavior of engineering materials based upon bond type, structure, composition, and processing.
- Study chemical kinetics using concepts of computational chemistry.
- Discuss how spectroscopic methods are used for qualitative and quantitative analyses.
- Analyse impurities present in the water and suggest the methodology for its removal

### Syllabus

**Unit 1: Solid State Chemistry (7 Hours)**

**Bondings in atoms:** Primary bonding: ionic, covalent, metallic. Secondary bonding: dipole-dipole, induced dipole-induced dipole, London dispersion/van der Waals, hydrogen. Shapes of molecules: hybridization, LCAO-MO, VSEPR theory.

**Electronic material:** Band theory: metals, insulators, and semiconductors. Band gaps, doping. Silicon wafer production.

**Unit 2: Nano-material-I(7 Hours)**

**Basics of Nanochemistry:** Defination of Nano, Scientific revolution-Atomic Structure and atomic size, emergence and challengs of nanoscience and nanotechnology, carbon age-new form of carbon (CNT to Graphene), One dimensional, Two dimensional and Three dimensional nanostructured materials, mechanical-physical-chemical properties.

**Application of Nanomaterial:** Molecular electronics and nanoelectronics, Nanotechnology for waste reduction and improved energy efficiency, Carbon Nanotubes for energy storage, Hydrogen Storage in Carbon Nanotubes, nanotechnology based water treatment strategies.

**Unit 3: Advanced Materials: (7 hours)**

**Composite materials:** Introduction, Classification: Polymer Matrix Composites, Metal Matrix Composites, Ceramic Matrix Composites, Carbon–Carbon Composites, Fiber- Reinforced Composites and Applications.

**Reinforcements:** Fibres- Glass, Kevlar, Carbon, Silicon Carbide, And Born Carbide Fibres.

**Industrial Polymer:** Thermoplastics, Thermosetting Plastics, Polymers used in electronic industries, Piezo and pyroelectric polymers, Polymers in optical media data storage devices.

**Unit 4: Computational Chemistry [6 Hours]**

Rate of the reaction, Order and Molecularity of the reaction, Rate expression for Zero Order, First Order and Second Order Reactions, Effect of the temperature, Use of Mathematica for determining rate of the reaction, etc.

**Unit 5: Material Characterization using different Spectroscopic Techniques [7 Hours]**

Fundamentals of spectroscopy, Infrared Spectroscopy, Electronic Spectrocopy, Nuclear Magnetic Resonance Spectroscopy.

Fundamentals of X-Ray Diffractions (XRD), X-Ray Fluorescence (XRF) spectroscopy.

**Unit 6: Water Technology [8 Hours]**

Impurities in natural water, hardness and alkalinity, Disadvantages of hardness i. e. sludge and scale formation, softening of water using lime-soda, zeolite and ion-exchange method, advantages and limitations of these water softening processes, Desalination of water using Reverse Osmosis.

## Text Books


1. J. Michael Hollas, Modern Spectroscopy, Fourth Edition, John Wiley and Sons, 2004.
2. William Kemp, Organic Spectroscopy, Third Edition, Palgrave Publication, 1991.
3. Bradley D. Fahlman, Materials Chemistry, Third Edition, Springer Nature, 2018.
4. Brian W. Pfennig, Principles of Inorganic Chemistry, John Wiley and Sons, 2015.
5. Steven S. Zumdahl, Donald J. DeCoste, Chemical Principles,Eighth Edition, Cengage Learning, 2017.
6. Catherine E. Housecroft and Edwin C. Constable, Chemistry: An Introduction to Organic, Inorganic and Physical Chemistry, Third Edition, Pearson Education Limited, 2006.
7. Michael J. Moran and Howard N. Shapiro, Fundamentals of Engineering Thermodynamics, Fifth Edition, John Wiley and Sons, 2006.
8. Donald L. Pavia, Gary M. Lampman, George S. Kriz, and James R. Vyvyan, Introduction to Spectroscopy, Fifth Edition, Cengage Learning, 2009.
9. C. N. R. Rao, A. Muller and A. K. Cheetham, The Chemistry of Nanomaterials: Synthesis, Properties and Applications, Wiley-VCH, 2004.
10. P. C. Jain and Monica Jain, Engineering Chemistry, Dhanpat Rai Publication.
11. S. S. Dara, A Textbook ofEngineering Chemistry, S. Chand Publications.
12. J. D. Lee, Concise Inorganic Chemistry, Fourth Edition, Chapman and Hall Publications.

## Syllabus for Semester I, BE Computer Science & Engineering (Data Science)

**Course Code : CHP152** **Course : Chemistry Lab**

**L: 0 Hrs, T: 0 Hr, P: 3 Hr, Per Week** **Total Credits : 1.5**

### Course Outcomes

The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering.

The students will learn to:

- Estimate the amount of different impurities in water/waste water samples.
- Estimate rate constants of reactions and order of the reaction from concentration of reactants/products as a function of time and to validate adsorption isotherms.
- Measure molecular/system properties such as surface tension, viscosity of aqueous or other industrially important liquids/mixtures etc.
- Synthesize a polymer or drug molecule or nano-material.
- Use principle of spectroscopic techniques for structural determination.

**List of Experiments: [Any Eight from the List]**

[1] Preparation of different Solutions: Molar solution, Normal solution and percent solution and Determination of concentration.

[2] To find out types of alkalinity and estimation of their extent in the water sample.

[3] Estimation of temporary, permanent and total hardness present in the water sample using complexometric titration method.

[4] Spectroscopic/Colorimetric determine of wavelength of maximum absorption of chemical/biological compound in solution and determination of concentration using Lambert-Beer's Law.

[5] Determination of rate of the reaction of hydrolysis of ethyl acetate at room temperature and analysis of experimental data using Computational Software.

[6] To study chemical kinetics of peroxydisulphate and iodide ions reactions and to find out order of the reaction and analysis of experimental data using Computational Software.

[7] Synthesis of Nano-material/Polymer and its study.

[8] Determination of relative and kinematic viscosities of aqueous solutions of Poly-ethylene glycol (Polymeric Liquid) using Redwood Viscometer (type I or II) at different temperatures.

[9] To study effect of bondings of water molecules with electrolyte (NaCl/KCl) and non-electrolyte solute (Soap) in the solution through Surface Tension Determination.

[10] Study of ion-exchange column for removal of hardness in the water sample.

[11] Demonstrations of organic spectral techniques: IR, NMR.

[12] Demonstration of in-organic spectral techniques: XRD, XRF.

## Text Books / Reference Books

(1) S. S. Dara, A Textbook on Experiments and Calculations in Engineering Chemistry, S. Chand Publications.

(2) J. B. Yadav, Advanced Practical Physical Chemistry, Krishna's Prakashan Media (P) Limited.

(3) A. J. Elias, Collection of Interesting General Chemistry Experiments, Universities Press Publications.

(4) V. K. Ahluwalia, S. Dhingra and A. Gulati, College Practical Chemistry, Universities Press Publications.

(5) Ashutosh Kar , Advanced Practical Medicinal Chemistry, New Age International Publisher.

## Syllabus for Semester I, BE Computer Science & Engineering (Data Science)

**Course Code : MAT 152** **Course : Differential equations, Linear Algebra, Statistics & Probability**

**L: 3Hrs., T: 0 Hrs., P: 0 Hrs., Per week** **Total Credits: 03**

### Course Objective

The objective of this course is to familiarize the prospective engineers with techniques in Ordinary differential equation, statistics, probability and Matrices.

It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

### Course Outcomes

On successful completion of the course, the students will learn:

1. The effective mathematical tools for the solutions of ordinary differential equations that model physical processes.
2. The essential tool of matrices in a comprehensive manner.
3. The ideas of probability and various discrete and continuous probability distributions and the basic ideas of statistics including measures of central tendency, correlation and regression.

### Syllabus

**Module 1:First order ordinary differential equations(7 hours)**

Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree : equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

**Module 2: Ordinary differential equations of higher orders (8 hours)**

Second order linear differential equations with constant and variable coefficients, method of variation of parameters, Cauchy-Euler equation.

**Module 3:Basic Statistics: (7 hours)**

Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves, correlation and regression – Rank correlation, Multiple regression and correlation.

**Module 4: Basic Probability: (8 hours)**

Probability spaces, conditional probability, independence; Discrete random variables, Binomial distribution, Poisson distribution, Normal distribution. Relation between binomial, Poisson and Normal distributions.

**Module 5: Matrices (10 hours)**

Algebra of matrices, Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Eigen values and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, Orthogonal transformation and quadratic to canonical forms.

## Topics for Self Learning

Application of Differential Equations.

## Textbooks / References


1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edition, Wiley India, 2009.
3. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
4. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
5. E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
7. Theory and Problems of probability and statistics : 2nded :J. R. Spiegal ,Schaum series
8. A text book of Applied Mathematics Volume I & II, by P. N. Wartikar and J. N. Wartikar, Pune Vidhyarthi Griha Prakashan, Pune-411030 (India).
9. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.

## Syllabus for Semester I, BE Computer Science & Engineering (Data Science)

**Course Code : CDT101** **Course : Programming for Problem Solving**

**L: 4 Hrs, T: 0 Hr, P: 0 Hr, Per Week** **Total Credits : 4**

### Course Outcomes

On successful completion of course student will learn:

1. To formulate simple algorithms for arithmetic and logical problems, translate the algorithms to programs (in C language), test and execute the programs and correct syntax and logical errors.
2. To implement conditional branching, iteration and recursion, to decompose a problem into functions and synthesize a complete program using divide and conquer approach.
3. To use arrays, pointers, structures and I/O operations for the formulation of algorithms and programs.
4. To apply programming to solve matrix addition, multiplication problems and searching & sorting problems.

**UNIT-I: Introduction to Programming**

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) Idea of Algorithm : Steps to solve logical and numerical problems. Representation of Algorithm: Flowchart / Pseudocode with examples. Arithmetic expressions and precedence

**UNIT-II: C Programming Language**

Introduction to C language: Keywords, Constant, Variable, Data types, Operators, Types of Statements, Preprocessor Directives, Decision Control Statement-if, if-else, Nested if-else statement, Switch case, Loops and Writing and evaluation of conditionals and consequent branching.

**UNIT-III: Arrays and Basic Algorithms**

Arrays: 1-D, 2-D, Character arrays and Strings. Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

**UNIT-IV: Functions and Recursion**

User defined and Library Functions, Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference. Recursion: As a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

**UNIT-V: Pointers and Structures**

Structures, Defining structures, Array of Structures, Introduction to pointers, Defining pointers, Pointer arithmetic, pointer operators, Use of Pointers in self-referential structures, notion of linked list (no implementation)

**UNIT-VI: File handling**

Streams in C, Types of Files, File Input/ Output Operations: Modes of file opening, Reading and writing the file, Closing the files, using fflush().

## Text Books:

1. Programming in ANSI C : E. Balguruswami McGraw Hill
2. Mastering C: K. R. Venugopal and S. R. Prasad, Tata McGraw Hill

## Reference Books:

1. Programming with C: Byron Gottfried, Schaums Outline Series.
2. Let Us C: Yashwant Kanetkar, BPB Publication

## Syllabus for Semester I, BE Computer Science & Engineering (Data Science)

**Course Code : CDP101** **Course : Programming for Problem Solving Lab**

**L: 0 Hrs, T: 0 Hr, P: 2Hr, Per Week** **Total Credits : 1**

Course Outcomes :

On successful completion of course student will be able to:

1. Understand the fundamentals of C programming and choose the loops and decision making statements to solve and execute the given problem.
2. Implement different Operations on arrays also design functions to solve the given problem using C programming.
3. Understand pointers, structures, unions and apply them to develop programs.
4. Implement file Operations in C programming for a given application.

# Syllabus for Semester I, BE Computer Science & Engineering (Data Science)

**Course Code: IDT151** **Course: Creativity, Innovation & Design Thinking**

**L: 1 Hrs, T: 0 Hr, P: 0Hr, Per Week** **Total Credits : 1**

## Course Outcomes

1: Be familiar with processes and methods of creative problem solving

2: Enhance their creative and innovative thinking skills

3: Practice thinking creatively and innovative design and development

**Detailed Topics**

**UNIT I. Introduction:** Making a case for creativity, Creative thinking as a skill, Valuing diversity in thinking: Thinking preferences, Creativity styles, Creativity in problem solving

**UNIT 2. Pattern Breaking:** Thinking differently , Lateral thinking, Mind stimulation: games, brain-twisters and puzzles, Idea-collection processes, Brainstorming/Brainwriting, The SCAMPER methods, Metaphoric thinking, Outrageous thinking , Mapping thoughts, Other (new approaches)

**UNIT 3.** Using Math and Science, Systematic logical thinking, Using math concepts, Eight-Dimensional (8D) Approach to Ideation: Uniqueness, Dimensionality, Directionality, Consolidation, Segmentation, Modification, Similarity, Experimentation

**UNIT4. Systematic Inventive Thinking:** Systematic inventive thinking: The TRIZ methodology, Decision and Evaluation: Focused thinking framework, Six thinking hats , Ethical considerations

**UNIT 5. Design for Innovation:** Introduction to design for interaction, nine lessons for innovation, difference in creativity and innovation, Building blocks for innovation

**UNIT 6.Intellectual Property:** Introduction to intellectual property: Patents, Copyrights©, Trademarks ®, Trade Secret, Unfair Competition.

## Reference Books and Text Book


1. Creative Problem Solving for Managers - Tony Proctor - Routledge Taylor & Francis Group
2. 101 Activities for Teaching creativity and Problem Solving - By Arthur B Vangundy - Pfeiffer
3. H. S. Fogler and S.E. LeBlanc, Strategies for Creative Problem Solving, Prentice Hall
4. E. Lumsdaine and M. Lumsdaine, Creative Problem Solving, McGraw Hill,
5. J. Goldenberg and D. Mazursky, Creativity in product innovation. Cambridge University Press, 2002.


**Course Assignments for internal continuous assessment of 20 Marks (NO T1 and T2)**

- Brain teasers (aka Puzzle Busters, to be solved individually)
- Cartoon captions (small teams)
- TRIZ, a systematic ideation method, reading (individual)
- Book readings and discussions (small teams)
- Small teams presentations on innovation: (1) innovative individual, (2) innovative company, ( 3) innovative movie / game, (4) sustainable innovation, (5) innovation in business, (6) innovation in art, (7) innovation in architecture, (8) innovative nation, (9) innovation in science, and (10) innovation in engineering.
- Large groups hands-on projects
- Eight-dimensional (8D) ideation method examples
- Large teams videos

## Syllabus for Semester I, BE Computer Science & Engineering (Data Science)

**Course Code : CDT102** **Course : Computer Workshop**

**L: 1 Hrs, T: 0 Hr, P: 0Hr, Per Week** **Total Credits : 1**

### Course Objectives

1. Understand the fundamentals of writing Python code
2. Learn core Python coding concepts such as data types, variables and flow control structures
3. Discover how to work with lists and sequence data, dictionaries & write functions
4. Use Python to read and write files

**Introduction to Python:** Installation and working with Python, Variables, Basic Operators

**Python Data Types:** int , float, complex, User Input, Arithmetic Expressions ,Using Strings and Operations on Strings, Use of list and list slicing, Use of Tuples

**Flow Control:** Conditional blocks: if, else, elif, For Loops in Python: Loops with range, Strings, List and Dictionaries, While Loop

**Python Functions:** Defining a function, using a function

Python String, List and Dictionary manipulations

**Files:** Reading and Writing Files in Python, File Operations

### Course Outcomes

On successful completion of the course, students will be able to:

1. Learn basic fundamentals of writing a python code
2. Understand Lists, Dictionaries in Python.'
3. Create Functions in Python
4. Handle Strings and Files in Python

### Text Books

1. Python Programming Using Problem Solving Approach: Reema Thareja, Oxford University Press; First edition

## Syllabus for Semester I, BE Computer Science & Engineering (Data Science)

**Course Code : CDP102** **Course : Computer Workshop Lab**

**L: 0 Hrs, T: 0 Hr, P: 2Hr, Per Week** **Total Credits : 1**

### Course Objectives

Throughout the course, students will be expected to learn Python Language basics to do the following:

1. Understand basic concepts of python code writing
2. Understand the basics of control flow operations, Use of Lists, Dictionaries
3. Develop program using functions
4. Develop programs for file handling

### Syllabus

Programs based on:

1. Python Data Types
2. Flow Control
3. Functions
4. String
5. File handling

### Course Outcomes

On successful completion of the course, students will be able to:

1. Write basic python code
2. Implement flow control in python
3. Implement functions in Python
4. Write python code for file handling

## Syllabus for Semester I, BE Computer Science & Engineering (Data Science)

**Course Code : HUT151** **Course : English**

**L: 2 Hrs, T: 0 Hr, P: 0Hr, Per Week** **Total Credits : 2**

### Course Objectives

The main objective of the subject is to enhance the employability skills of engineering students as well as communication skills at work place. The sub-objectives are:

1. To develop vocabulary of students.
2. To orient students in basic writing skills.
3. To orient students in functional grammar.
4. To orient students in the process of effective writing.
5. To provide practice and improve students' oral communication skills.

### Course Outcomes

1. Students will have good word power.
2. Students will acquire basic writing skills.
3. Students will understand functional grammar and its usage.
4. Students will organize and express their thoughts effectively through written communication.
5. Students will learn oral communication skills in order to handle themselves effectively in an interview and group discussion

### SYLLABUS

**1. Vocabulary Building**

1.1. The concept of Word Formation

1.2. Root words from foreign languages and their use in English

1.3. Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives

1.4. Synonyms, Antonyms and standard abbreviations

**2. Basic Writing Skills**

2.1 Sentence Structures

2.2 Use of phrases and clauses in sentences

2.3 Importance of proper punctuation

2.4 Creating coherence

2.5 Organizing principles of paragraphs in documents

2.6 Techniques for writing precisely

**3. Identifying Common Errors in Writing**

3.1 Subject-verb agreement

3.2 Noun-pronoun agreement

3.3 Misplaced modifiers

3.4 Articles

3.5 Redundancies

3.6 Cliches

**4. Nature and Style of sensible Writing**

4.1 Describing

4.2 Defining

4.3 Classifying

4.4 Providing examples or evidence

**5. Writing Practices**

5.1 Comprehension

5.2 Precis Writing

5.3 Essay Writing

5.4 Letter Writing

5.5 Email Writing

**6. Oral Communication**

(This unit involves interactive practice sessions in Language Lab)

- Listening Comprehension
- Pronunciation, Intonation, Stress and Rhythm
- Common Everyday Situations : Conversations and Dialogues
- Communication at Workplace
- Interviews
- Formal Presentations

## Books

1. Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
2. Practical English Usage. Michael Swan. OUP. 1995.
3. Remedial English Grammar. F.T. Wood. Macmillan.2007
4. On Writing Well. William Zinsser. Harper Resource Book. 2001
5. Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
6. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

## Syllabus for Semester I, BE Computer Science & Engineering (Data Science)

**Course Code : HUP151** **Course : English Lab**

**L: 0 Hrs, T: 0 Hr, P: 2Hr, Per Week** **Total Credits : 1**

### Course objective

1. To enhance competency of communication in English among learners.

### Course outcomes

1. Students learn presentation and public speaking skills
2. Students learn to practice effective strategies for Personal Interview and Group Discussions
3. Students learn and effectively apply language skills – listening, speaking, reading and writing

**List of Practical (2 hours each for each batch) based on unit 6 (oral communication).**

1. Common Everyday Situations: Conversations and Dialogues
2. Pronunciation, Intonation , Stress, and Rhythm
3. Formal Presentations: Orientation
4. Formal Presentations : Practice Session
5. Interviews: Orientation
6. Interviews: Practice Session
7. Communication at Workplace: Group Discussion- Orientation
8. Communication at Workplace: Practice Session

## Syllabus for Semester II, BE Computer Science & Engineering (Data Science)

**Course Code : PHT156** **Course : Semiconductor Physics**

**L: 3 Hrs, T: 1 Hr, P: 0Hr, Per Week** **Total Credits : 4**

## Course Objectives

1. To introduce ideas of quantum mechanics necessary to begin understanding semiconductor devices;

2. To familiarize prospective engineers with fundamental concepts of semiconductors and their interaction with light and resulting devices

## Course Outcomes

After successful completion of the course students will

1. have an elementary understanding of quantum behaviour of electrons in solids;
2. have a grasp of band structure and its consequences for semiconductors;
3. should be able to use band structure to explain effects of doping,on the properties of junctions between semiconductors and metals;
4. have an elementary understanding of working of optoelectronic devices.

**Module 1: Quantum Mechanics Introduction**

Wave-particle duality, Heisenberg uncertainty relations, the quantum state wave function and its probability interpretation, Schrodinger's equation, Energies and wave functions of a single electron in one-dimensional infinite potentials: formulae, function graphs, number of bound states, tunneling, one Electron Atom, Periodic Table, Quantum confinement effects in nanosystems

**Module 2: Electronic Materials**

Free electron theory, Extension of idea of energy level splitting in molecules to bonding in solids, Energy bands in solids, Kronig-Penny model (to better demonstrate origin of band gaps), Band gap based classification of electronic materials: metals, semiconductors and insulators, E-k diagram, Direct and indirect bandgaps, Valence and conduction bands, Density of states, Fermi-Dirac statistics: Occupation probability of states, Fermi level, Effective mass.

**Module 3: Intrinsic and Extrinsic Semiconductors**

Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), Carrier transport: diffusion and drift

**Module 4: Non-Equilibrium Semiconductors**

Carrier generation and recombination, Continuity equation, Ambipolar transport equation, Quasi-Fermi Energy levels, Excess Carrier Lifetime, Qualitative introduction to recombination mechanisms, Shorkley-Read-Hall Recombination, Surface Recombination

**Module 5: Junction Physics**

p-n junction, Zero applied bias, forward bias, reverse bias, Metal-semiconductor junction, Shottky barrier, Ideal junction properties, Ohmic contacts, ideal non-rectifying barrier, tunneling barrier, Heterojunctions, Nanostructures, Energy band diagram, two dimensional electron gas

**Module 6: Light - Semiconductors Interaction**

Optical absorption in semiconductors, Light emitting diodes, Principles, Device Structures, Materials, High Intensity LEDs, Characteristics, LASERS, Stimulated emission and photon amplification, Einstein Coefficients, Laser oscillation conditions, Laser diode, Solar Energy Spectrum, photovoltaic device principles, Solar Cells

## Text Book(s)

**Modules 1-5**

1. Semiconductor Physics and Devices (Fourth Edition), Donald A. Neamen, McGraw-Hill 2012.

## References

**Modules 6**

1. Online course: Semiconductor Optoelectronics by M. R. Shenoy on NPTEL
2. Optoelectronics and Photonics: Principles and Practices by S. O. Kasap, Prentice Hall 2001

## Syllabus for Semester II, BE Computer Science & Engineering (Data Science)

**Course Code : PHP156** **Course : Semiconductor Physics Lab**

**L: 0 Hrs, T: 0 Hr, P: 3Hr, Per Week** **Total Credits : 1.5**

### Course Outcomes

The Physics Laboratory course will consist of experiments illustrating the principles of physics relevant to the study of science and engineering. Students will show that they have learnt laboratory skills that will enable them to properly acquire and analyze the data in physics laboratory and draw valid conclusions. At the end of the Course the students will learn to:

1. Develop skills to impart practical knowledge in real time.
2. Understand principle, concept, working and application of areas in physics and compare the results obtained with theoretical calculations.
3. Understand measurement technique, and report the results obtained through proper graph plotting and error analysis.

In addition to the demo experiments, the Lab turns will be utilized for performing the experiments based on the following lists as specific to Program

1. Error analysis and graph plotting
2. Energy gap of semiconductor/thermister
3. Study of Hall Effect
4. Parameter extraction from I-V characteristics of a PN junction diode
5. Parameter extraction from I-V characteristics of a zener diode
6. Study of diode rectification
7. Parameter extraction from I-V characteristics of a transistor in common-emitter configuration.

   Determination of Planck's constant
9. Determination of time constant of RC circuit
10. V-I Characteristics of Light Emitting Diodes
11. Study of a photodiode
12. Solar Cell (Photovoltaic cell)
13. Resistivity measurement by Four Probe method
14. Van der Pau and conventional techniques for resistivity measurement (LCR meter)
15. Study of R-C filters using C.R.O.
16. Data analysis using Mathematica.

A minimum of 8 experiments to be performed from the following list of experiments

## Syllabus for Semester II, BE Computer Science & Engineering (Data Science)

**Course Code : MAT151** **Course : Calculus**

**L: 3 Hrs, T: 1 Hr, P: 0 Hr, Per Week** **Total Credits : 4**

### Course Objective

The objective of this course is to familiarize the prospective engineers with techniques in Calculus and multivariate analysis. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

### Course Outcomes

On successful completion of the course, the students will learn:

1. The fallouts of Mean Valve Theorems that is fundamental to application of analysis to Engineering problems, to deal with functions of several variables that are essential in most branches of engineering.
2. Basics of improper integrals, Beta and Gamma functions, Curve Tracing, tool of power series and Fourier series for learning advanced Engineering Mathematics.
3. Multivariable Integral Calculus and Vector Calculus and their applications to Engineering problems.

### Syllabus

**Module - I : Differential Calculus: (12hours)**

Taylor's and Maclaurin's series expansions; radius of curvature (Cartesian form), evolutes and involutes, Limit and continuity of functions of several variables and their partial derivatives, Eulers Theorem, chain rule, total derivative, Jacobians, Maxima, minima and saddle points; Method of Lagrange multipliers.

**Module - II : Integral Calculus: (6 hours)**

Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Tracing of curves (Cartesian form)

**Module - IV : Sequences and series: (7 hours)**

Convergence of sequence and series, tests for convergence, power series, Fourier series: Half range sine and cosine series, Parseval's theorem.

**Module - V : Multiple Integrals (10 hours)**

Multiple Integration: Double and triple integrals (Cartesian and polar), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: area, mass and volume by double integration, Center of mass and Gravity (basic concepts).

**Module - VI : Vector Calculus (10 hours)**

Vector Differentiation, Directional derivatives, total derivative, Gradient, Curl and Divergence. Vector integration , Theorems of Green, Gauss and Stokes and their applications.

**Topics for self learning**

Rolle's theorem, Mean value theorems, Indeterminate forms , Maxima and minima for function of one variable, Geometrical interpretation of Partial Differentiation( Tangent plane and Normal line ) , Applications of definite integrals to evaluate perimeter, area, surface areas and volumes of revolutions.

## Textbooks/References


1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
3. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
5. P. N. Wartikar and J. N. Wartikar, A text book of Applied Mathematics Volume I & II, Pune Vidhyarthi Griha Prakashan, Pune-411030 (India).

## Syllabus for Semester II, BE Computer Science & Engineering (Data Science)

**Course Code : MAP151** **Course: Computational Mathematics lab**

**L: 0 Hrs, T: 0 Hr, P: 2Hr, Per Week** **Total Credits : 1**

### Course Outcomes

The Computational Mathematics Lab course will consist of experiments demonstrating the principles of mathematics relevant to the study of science and engineering. Students will show that they have learnt laboratory skills that will enable them to properly acquire and analyze the data in the lab and draw valid conclusions. At the end of the Course the students will learn to:

1. Develop skills to impart practical knowledge in real time.
2. Understand principle, concept, working and application of areas in mathematics and compare the results obtained with theoretical calculations.
3. Understand basics of mathematics, and report the results obtained through proper programming.

**The Lab turns will be utilized for performing the experiments based on the following list:**

1. Calculus
2. Ordinary Differential Equations
3. Statistics
4. Linear Algebra

### Suggested References

1. Computational Mathematics Lab Manual written by the Teaching Faculty of Mathematics Department, RCOEM.

A minimum of 8 experiments to be performed based on the above list.

# Syllabus for Semester II, BE Computer Science & Engineering (Data Science)

**Course Code : CDT103** **Course : Digital Electronics**

**L: 3 Hrs, T: 0 Hr, P: 0Hr, Per Week** **Total Credits : 3**

## Course Outcomes

After successful completion of this course, the student will be able to,

1. Understanding of various optimization techniques used to minimize and design digital circuits.
2. Analyze and design various combinational logic circuits.
3. Analyze and design various sequential circuits.
4. Design different microprocessor based components of computer system using combinational and sequential circuits.

## Course Contents

**UNIT-I- Basics of Digital Electronics**

Motivation for digital systems: Logic and Boolean Algebra, Number Systems. Logic Gates & Truth Tables, Demorgan's law, Minimization of combinational circuits using Karnaugh maps upto five variable. Map manipulation-essential prime implicants, non essential prime implicants.

**UNIT-II – Combinational Circuit Design**

Design procedure: Multiplexers, Demultiplexer, Encoders ,Decoders ,Code Converters, Adders , Subtractor (Half ,Full), BCD Adder/ Subtractor , ripple and carry look-ahead addition.

**UNIT-III- Sequential circuit Design-I**

Storage elements, Flip-flops and latches: D, T, J/K, S/R flip-flops. Master Slave Conversion of one of type of F/F to another Sequential circuit. Analysis –Input equations, state table, analysis with J-K Flip flops. Sequential circuit Design, Design procedure, Designing with D & J-K Flip flop.

**UNIT-IV-Sequential circuit Design-II**

Counters, asynchronous and synchronous design using state and excitation tables. Registers & Shift registers.

**UNIT-V- Programmable logic Design**

Memory & Programmable logic Devices: RAM, Array of RAM IC's, Read only Memory, PLA, PAL, Flash Memories

**UNIT-VI- Fundamental of Microprocessor**

Introduction to $\mu$p 8085, Addressing modes, Instruction set, Programming of $\mu$p 8085.

## Text Books

1. Morris Mano; Digital Logic Design; Fourth edition, McGraw Hill
2. R.P.Jain; Modern Digital Electronic; Fourth edition; Tata McGraw-Hill.
3. V.J.Vibhute; 8-Bit Microprocessor & Microcontrollers; fifth edition.

## Reference Books

1. A. Anand Kumar; Fundamental of Digital Electronics; Second Edition, PHI
2. A.P.Godse; Digital circuit & design; Technical Publications; 2009.
3. Ramesh Gaonkar; 8 bit Microprocessor; CBS Publishers; 2011.

## Syllabus for Semester II (BE CSE)
## Data Science

**Course Code : CDP103** **Course : Digital Electronics Lab**

**L: 0 Hrs, T: 0 Hr, P: 2Hr, Per Week** **Total Credits : 1**

### Course Outcome

On Successful completion of course, students will be able to:

1. Use logic gates for designing digital circuits
2. Implement combinational circuits using VHDL
3. Implement sequential circuits using VHDL
4. Apply the knowledge gained for their project work based on the hardware digital circuits

**Practicals based on above theory syllabus**

## Syllabus for Semester II, BE Computer Science & Engineering (Data Science)

**Course Code : CDT104** **Course : Object Oriented Programming**

**L: 3Hrs, T: 0 Hr, P: 0Hr, Per Week** **Total Credits : 3**

## Course Objectives

1. To make students understand Fundamental features of an object oriented language like Java: object classes and interfaces, exceptions and libraries of object collections

2. Introduce students with fundamental concepts like exception handling, generics, multithreading and streams.

## SYLLABUS

### UNIT I

Features of Object Oriented Programming languages, Abstraction, Encapsulation, Inheritance, polymorphism and late binding.Concept of a class, Access control of members of a class, instantiating a class, constructor and method overloading.

### UNIT II

Concept of inheritance, methods of derivation, use of super keyword and final keyword in inheritance, run time polymorphism, abstract classes and methods, Interface, implementation of interface, creating packages, importing packages, static and non-static members, Lambda Expressions Introduction, Block, Passing Lambda expression as Argument.

### UNIT III

Exceptions, types of exception, use of try catch block, handling multiple exceptions, using finally, throw and throws clause, user defined exceptions, Introduction to streams, byte streams, character streams, file handling in Java, Serialization.

### UNIT IV

Generics, generic class with two type parameter, bounded generics. Collection classes: Arraylist, LinkedList, Hashset, Treeset .

### UNIT V

Multithreading: Java Thread models, creating thread using runnable interface and extending Thread, thread priorities, Thread Synchronization, InterThread communications.

### UNIT VI

Introduction to Design Patterns, Need of Design Pattern, Classification of Design Patterns, Role of Design Pattern in Software design, Creational Patterns, Structural Design Patterns and Behavioral Patterns.

## Course Outcomes

On successful completion of the course, students will be able to demonstrate

1. Understand the principles of object-oriented programming; create classes, instantiate objects and invoke methods.
2. Understand concept of generics and implement collection classes. Use exception handling mechanism.
3. Efficiently work with streams, use multithreading for solving classic synchronization problems. Perform java database connectivity and execute basic SQL commands.
4. Understand characteristics and need of Design Pattern in Software Design Process.

## Text Books

1. Herbert Schildt; JAVA The Complete Reference; Ninth Edition, Tata McGraw- Hill Publishing Company Limited.
2. Design Patterns By Erich Gamma, Pearson Education.

## Reference Books

1. Cay S. Horstmann and Gary Cornell; Core JAVA Volume-II Advanced Features; Eighth Edition; Prentice Hall, Sun Microsystems Press 2008.
2. Herbert Schildt and Dale Skrien; Java Fundamentals A Comprehensive Introduction; Tata McGraw- Hill Education Private Ltd 2013.

## Syllabus for Semester II, BE Computer Science & Engineering (Data Science)

**Course Code : CDP104** **Course : Object Oriented Programming Lab**

**L: 0Hrs, T: 0 Hr, P: 2Hr, Per Week** **Total Credits : 1**

### Course Objectives

1. To develop ability of students to implement basic concepts and techniques of object oriented programming paradigm like encapsulation, inheritance, polymorphism, exception handling.
2. Develop solution to problems using collection classes, generics, streams, multithreading.

### SYLLABUS

Experiments based on above Syllabus.

### Course Outcomes:

On completion of the course the student will be able to

1. Design solution to problems using concepts of object oriented programming like classes, objects, inheritance with proper exception handling.
2. Use collection classes, generic classes to design programs and perform database connectivity.
3. Implement programs based on streams and multithreading.

## Syllabus for Semester II, BE Computer Science & Engineering (Data Science)

**Course Code : HUT152** **Course : Constitution of India**

**L: 2 Hrs, T: 0 Hr, P: 0Hr, Per Week** **Total Credits : 0**

### Course outcome

1. Students will understand the role of constitution in democratic India
2. Students will be responsible students by knowing their fundamental rights and duties
3. Students will develop better understanding of democratic functions of the government of India
4. Students will form better understanding of system of governance for effective participation

### Course content

1. Meaning of the constitution law and constitutionalism
2. Historical perspective of the Constitution of India
3. Salient features and characteristics of the Constitution of India
4. Scheme of the Fundamental Rights
5. The scheme of the Fundamental Duties and its legal status
6. The Directive Principles of State Policy – Its importance and implementation
7. Federal structure and distribution of legislative and financial powers between the Union and the States
8. Parliamentary Form of Government in India – The constitution powers and status of the President of India
9. Union Executive: structure, functions
10. Judiciary: Structure, role with special reference to PIL, writ petitions, strengthening of democracy & social Justice
11. Amendment of the Constitutional Powers and Procedure
12. Emergency Provisions: National Emergency, President Rule, Financial Emergency
13. Local Self Government – Constitutional Scheme in India
14. Provisions of civil services: Characteristics, functions, merits and demerits
15. Democratic principles in industry

### Book

1. Durga Das Basu "An Introduction to Constitution of India" 22nd Edition, LexisNexis

## Syllabus for Semester II, BE Computer Science & Engineering (Data Science)

**Course Code : PEP151** **Course: Yoga / Sports**

**L: 0Hrs, T: 0 Hr, P: 2Hr, Per Week** **Total Credits : 0**

## Course outcome

On successful completion of the course, students will be able to:

1. Understand fundamental skills and basic rules of games offered by the Physical Education Department of RCOEM.
2. Obtained health related physical fitness.
3. Develop body-mind co-ordination through games and yoga.
4. Changed sedentary life styles towards active living.

**Brief Objectives of Sports/Yoga Practical Classes:**

It has long been proven that a healthy body leads to a healthy mind. With a strong belief in this, Physical Education Department at RCOEM will conduct Sports/Yoga Classes with the objective of maintaining health, fitness and wellness of students as well as create awareness about need for good health and physical fitness. The objective would also be to make the all-round development with team spirit, social values as well as to identify and develop leadership qualities in students through various sports activities. Sports activities would also be conducted with the objective to provide better interaction and recreation to the students which is an important neutralizer for stress. Additionally, the objective would be to evaluate the health related fitness of students so as to recommend and conduct specific Yoga and Sports activities. The emphasis is on participation, with healthy competition.

## Programme Outline

- **Sports**

1. Introduction to sports, offered by the department.
2. Health and safety issues related to sports; knowledge, recognition and ability to deal with injuries and illness associated with sports.
3. Practicing the fundamental skills and bringing awareness of basic rules and regulations.
4. Conduction of small recreational games and activities.

- **Yoga :** Includes various sitting, standing and lying Asanas, Suryanamaskars and Pranayamas.
- **Physical Efficiency Tests :** This includes 6 health related physical fitness tests.

## Syllabus for Semester III, BE Computer Science & Engineering (Data Science)

**Course Code : MAT272** **Course: Mathematics for Data Science**

**L: 3 Hrs, T: 0 Hr, P: 0 Hr, Per Week** **Total Credits : 3**

### Course Objective

The objective of this course is to familiarize the prospective engineers with techniques in linear algebra and statistics. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

### Course Outcomes

On successful completion of the course, the students will learn:

1. Computational techniques and algebraic skills essential for the study of systems of linear equations, matrix algebra, vector spaces, eigen values and eigenvectors, orthogonality and diagonalization.
2. Visualization, spatial reasoning, as well as geometric properties and strategies to model, solve problems, and view solutions, especially in R2 and R3, as well as conceptually extend these results to higher dimensions.
3. To prepare the background of students to pursue statistical theory or methodology and analyze data in any stream of computer science and information technology.

**Module - 1 (10-Lectures) :**

Data summaries and descriptive statistics, central tendency, variance, covariance, correlation, Simple and multiple Regression, Non linear regression, logistic regression.

**Module - 2 (8-lectures):**

T-distribution, Z-distribution, Hypothesis testing for sampling distributions of means, proportions, sum and differences of means and proportions for large and small samples. Chi-square test, ANOVA Test.

**Module - 3 (10-Lectures)**

Vector Space; Subspaces; Linear Dependence/Independence; Basis; Dimension; Linear transformation; Range Space and Rank; Null Space and Nullity; Rank nullity theorem, Matrix Representation of a linear transformation; Linear Operators on Rn and their representation as square matrices; Invertible linear operators; Inverse of a non-singularmatrix.

**Module 4 (8 - Lectures):**

Eigenvalues and eigenvectors of a linear operator; Inner Product Spaces, Norm; Orthonormal Sets, Gram Schmidt orthogonalization process; projections, positive definite matrices, and Singular Value Decomposition, Principal Component Analysis.

## Text Books

(1) Hoffman and Kunze : Linear Algebra, Prentice Hall of India, New Delhi

(2) Gilbert Strang : Linear Algebra And Its Applications (Paperback) , Nelson Engineering (2007)

(3) M R. Spiegal : Theory and Problems of probability and statistics :,2nded :,Schaum series

## Reference Books

(1) Seymour Lipschutz et al: Linear Algebra, 3rded:Schaum series.

(1) V. Krishnamoorthy et al : An introduction to linear algebra , Affiliated East West Press, New Delhi P. G. Bhattacharya, S. K. Jain and S. R.

(2) Nagpaul : First course in Linear Algebra, Wiley Eastern Ltd., New Delhi

(3) K.B.Datta : Matrix and Linear Algebra, Prentice Hall of India, New Delhi

(4) S.C. Gupta and V. K. Kapoor: Fundamentals of Mathematical Statistics (A Modern Approach), 10th Edition.

## Syllabus for Semester III, BE Computer Science & Engineering (Data Science)

**Course Code : CDT201** **Course : Data Structures and Algorithms**

**L: 3 Hrs, T: 0 Hr, P: 0 Hr, Per Week** **Total Credits : 3**

Course Objectives

1. To impart to students the basic concepts of data structures and algorithms.
2. To familiarize students on different searching and sorting techniques.
3. To prepare students to use linear (stacks, queues, linked lists) and non-linear (trees, graphs) datastructures.
4. To enable students to devise algorithms for solving real-world problems.

## SYLLABUS

**UNIT - I : Data Structures and Algorithms Basics**

**Introduction:** basic terminologies, elementary data organizations, data structure operations; abstract data types (ADT) and their characteristics. Algorithms : Definition, characteristics, analysis of an algorithm, asymptotic notations, time and space tradeoffs. Array ADT: definition, operations and representations – row-major and column- major.

**UNIT - II : Stacks and Queues**

**Stack ADT:** allowable operations, algorithms and their complexity analysis, applications of stacks –expression conversion and evaluation (algorithmic analysis), multiple stacks.

**Queue ADT:** Allowable operations, algorithms and their complexity analysis for simple queue and circular queue, introduction to double-ended queues and priority queues.

**UNIT - III : Linked Lists**

Singly Linked Lists: representation in memory, algorithms of several operations: traversing, searching, insertion, deletion, reversal, ordering, etc. Doubly and Circular Linked Lists: operations and algorithmic analysis. Linked representation of stacks and queues, header node linked lists.

**UNIT - IV : Sorting and Searching**

**Sorting :** Different approaches to sorting, properties of different sorting algorithms (insertion, Shell, quick, merge, heap, counting), performance analysis and comparison.

**Searching :** Necessity of a robust search mechanism, searching linear lists (linear search, binary search)and complexity analysis of search methods.

**UNIT - V : Trees**

Trees: basic tree terminologies, binary tree and operations, binary search tree [BST] and operations with time analysis of algorithms, threaded binary trees. Self-balancing Search Trees: tree rotations, AVL tree and operations, B + -tree: definitions, characteristics, and operations (introductory).

**UNIT - VI : Graphs and Hashing**

**Graphs :** Basic terminologies, representation of graphs, traversals (DFS, BFS) with complexity analysis, path finding (Dijkstra's SSSP, Floyd's APSP), and spanning tree (Prim's method) algorithms.

**Hashing :** Hash functions and hash tables, closed and open hashing, randomization methods (division method, mid-square method, folding), collision resolution techniques.

## Course Outcomes

On completion of the course the student will be able to

1. Recognize different ADTs and their operations and specify their complexities.
2. Design and realize linear data structures (stacks, queues, linked lists) and analyze theircomputation complexity.
3. Devise different sorting (comparison based, divide-and-conquer, distributive, and tree-based) and searching (linear, binary) methods and analyze their time and space requirements.
4. Design traversal and path finding algorithms for Trees and Graphs.

## Text Books

1. Ellis Horowitz, Sartaj Sahni& Susan Anderson-Freed, Fundamentals of Data Structures in C, Second Edition, Universities Press, 2008.
2. Mark Allen Weiss; Data Structures and Algorithm Analysis in C; Second Edition; Pearson Education; 2002.
3. G. A. V. Pai; Data Structures and Algorithms: Concepts, Techniques and Application; FirstEdition; McGraw Hill; 2008.

## Reference Books

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein; Introduction to Algorithms; Third Edition; PHI Learning; 2009.
2. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran; Fundamentals of Computer Algorithms; Second Edition; Universities Press; 2008.
3. A. K. Sharma; Data Structures using C, Second Edition, Pearson Education, 2013.

## Syllabus for Semester III, BE Computer Science & Engineering (Data Science)

**Course Code : CDP201** **Course : Data Structures and Algorithms Lab**

**L: 0 Hrs, T: 0 Hr, P: 4 Hr, Per Week** **Total Credits : 2**

### Course Objectives

1. To enable students to employ different searching and sorting methods.
2. To prepare students to identify and apply linear (stacks, queues, linked lists) and non-Linear(trees, graphs) data structures in solving problems.
3. To encourage students to design and execute tree-based algorithms for solving real-worldproblems.

### SYLLABUS

Experiments based on CDT201 Syllabus in C / C + +

### Course Outcomes

On completion of the course the student will be able to

1. Design and realize different linear data structures.
2. Identify and apply specific methods of searching and sorting to solve a problem.
3. Implement and analyze operations on binary search trees and AVL trees.
4. Implement graph traversal algorithms, find shortest paths and analyze them.

### Reference Books

1. K R. Venugopal and Sudeep. R Prasad; Mastering C; Second Edition; McGraw Hill; 2015.
2. Ellis Horowitz, Sartaj Sahni& Susan Anderson-Freed, Fundamentals of Data Structures in C, Second Edition, Universities Press, 2008.
3. Mark Allen Weiss; Data Structures and Algorithm Analysis in C; Second Edition; Pearson Education; 2002.

## Syllabus for Semester III, BE Computer Science & Engineering (Data Science)

**Course Code : CDT202** **Course : Computer Organization and Architecture**

**L: 3 Hrs, T: 0 Hr, P: 0 Hr, Per Week** **Total Credits : 3**

## Course Objectives

1. Introduction of the design structure, function and characteristics of computer systems.
2. To understand the design of the various functional units, components of computers and working of all the modules to get the expected output.

## SYLLABUS

**UNIT - I**

**Basic Structure Of Computers :** Functional units of computer. Instructions set architecture of a CPU-Instruction sequencing, Addressing modes, and instruction set classification, subroutine & parameter passing, expanding opcode.

**UNIT - II**

**Basic Processing Unit :** Bus architecture, Execution of a Complete Instruction, sequencing of control signals, Hardwired control, Micro-programmed Control.

**UNIT - III**

**Computer arithmetic :** Integer addition and subtraction, design of Fast Adders, Multiplication- shift and add, booth's Algorithm, bit-pair recoding, Integer Division- restoring and non-restoring division. Floating point numbers-representation, arithmetic, guard bits and rounding.

**UNIT - IV**

**Memory System Design :** Semiconductor RAM memories, ROM, higher order memory design, multi-module memories, Secondary storage – Magnetic disk, Optical disk.

**UNIT - V**

**Memory Organization :** Memory interleaving, concept of hierarchical memory, cache memory, cache size vs. block size, mapping functions, replacement algorithms, write policy. Pipelining: Basic concepts of pipelining, throughput and speedup.

**UNIT - VI**

**Input/output Organization :** I/O mapped I/O and memories mapped I/O, interrupt and interrupt handling mechanisms, vectored interrupts, synchronous vs. asynchronous data transfer, Direct Memory Access. Introduction to Parallel Computing : SISD, MISD, SIMD, MIMD.

## Course Outcomes

On Successful completion of course, students will be able to:

1. Understand the basic components of a computer, including CPU, memories, and input/output, and their organization.
2. Understand the execution of complete instruction and sequencing of control signals.
3. Understand the implementation process for mathematical operations on arithmetic and floating point.
4. Understand the memory hierarchy and its organization in Computer Architecture.

## Text Books

1. V. C. Hamacher, Z. G. Vranesic and S. G. Zaky; Computer Organisation; 5th edition; Tata McGraw Hill, 2002.
2. W. Stallings; Computer Organization & Architecture; PHI publication; 2001.
3. J. P. Hayes; Computer Architecture & Organization; 3rd edition; McGraw-Hill; 1998.

## Reference Books

1. M Mano; Computer System and Architecture; PHI publication; 1993.
2. A. S. Tanenbaum; Structured Computer Organization; Prentice Hall of India Ltd.

## Syllabus for Semester III, BE Computer Science & Engineering (Data Science)

**Course Code : CDP203** **Course : Advanced Object-Oriented Programming Lab**

**L: 0 Hrs, T: 0 Hr, P: 4 Hr, Per Week** **Total Credits : 2**

### Course Pre-requisites

CDT104 - Object Oriented Programming

CDP104 - Object Oriented Programming Lab

### Course Objectives

The objective of this course is to impart necessary and practical knowledge of recent Java based frameworks and develop skills required to design real-life web based projects by:

1. Designing Enterprise applications by encapsulating an application's business logic.
2. Designing and developing multi-tier web applications
3. Designing applications using existing frameworks like Spring and Hibernate.

### Syllabus

Experiments based on:

**JDBC Java Database Connectivity (JDBC):** The Design of JDBC, Basics of Structured Query Language, JDBC Configuration, Executing a basic SQL Statement, using PreparedStatement.

**Servlet :** Handling the Client Request, Generating HTML response, Reading Form Data From Servlets: Reading Three Parameters, managing a session.

**Java Server Pages (JSP) :** Invoking Java Code with JSP Scripting Elements, JSP directives and actions, Integrating Servlets and JSP

**Spring Framework :** Spring Bean Life Cycle, Spring Bean Scope, Basic Bean Wiring,

**Hibernate :** Hibernate Configuration, Hibernate Sessions, Collections Mappings, Association Mappings, Hibernate Query Language

### Course Outcomes

On successful completion of the course, the student will be able to:

1. Implement Java based database application.
2. Demonstrate server and client side programming using servlets and Java server pages.
3. Perform Dependency Injection using Spring, and create mappings in Hibernate using HQL.

## Text Books

1. M. Deitel, P. J. Deitel, S. E. Santry; Advanced Java 2 Platform HOW TO PROGRAM; Prentice Hall.
2. Cay Horstman, Gary Cornell; Core JAVA Volume-II Advanced Features; 8th Edition.
3. Craig Walls; Spring In Action; 2nd Edition
4. Marty Hall, Larry Brown; Core Servlets and Java Server Pages Volume-1: Core Technologies; 2nd Edition.

## Reference Books

1. Jim Keogh; "J2EE:The Complete Reference"; McGraw Hill; Fifth Edition.
2. Spring Framework Documentation https://spring.io/
3. Hibernate Framework architecture Documentation https://hibernate.org/

## Syllabus for Semester III, BE Computer Science & Engineering (Data Science)

**Course Code : CDP204** **Course : Technical Skill Enhancement Lab**

**L: 0 Hrs, T: 0 Hr, P: 4 Hr, Per Week** **Total Credits : 2**

### Course Objectives

The objective of this course is to familiarize the students with various web development tools/ languages.

### SYLLABUS

Practical to be based on following topics:

- Development of static web pages using HTML.
- Enhance above developed web pages by using CSS
- Validations of web pages using JavaScript
- XML Files and Document Type Definition (DTD) to validate the XML document.
- XHTML
- Implementation of PHP language

### Course Outcomes

On successful completion of the course, students will be able to:

1. Develop static and dynamic web pages using HTML, CSS, XML and XHTML.
2. Implement web programs using Java Scripts and JSP Struts.
3. Demonstrate client and server side programming using PHP.

### Text Books

1. Web Design: A Beginner Guide Second Edition by Wendy Willard
2. Introduction to XML and Web Technologies by Anders Moller

## Syllabus for Semester III, BE Computer Science & Engineering (Data Science)

**Course Code : CDP205** **Course : Statistical Programming Lab**

**L: 0 Hrs, T: 0 Hr, P: 2 Hr, Per Week** **Total Credits : 1**

### Course Objectives

The objective of this course is to familiarize the students with the use and applicationsof various statistical tools and packages.

Experiments may include, but are not limited to the following:

- Introduction to different statistical tools and packages
- Reading and writing different types of datasets
- Descriptive statics : Measures of central tendency and Measures of Variability
- Inferential statistics
- Probability distributions
- Binomial distributions
- Confidence Intervals
- Hypothesis Testing
- Correlation and covariance
- Regression

### Course Outcomes

On completion of the course the student will be able to

1. Understand and apply different statistical techniques on given data.
2. Perform and interpret different distribution.
3. Carry out hypothesis testing and calculate confidence intervals.
4. Create regression models.

### Reference Books

1. An Introduction to Statistics with Python: With Applications in the Life Science by Thomas Haslwanter, Springer.
2. Practical Statistics for Data Scientists by Peter Bruce, Andrew Bruce, Peter Gedeck, Reilly Media.

## Syllabus for Semester III, BE Computer Science & Engineering (Data Science)

**Course Code : HUT256** **Course : Indian Traditional Knowledge**

**L: 2 Hrs, T: 0 Hr, P: 0 Hr, Per Week** **Total Credits : 0**

### Course Objective

The course is designed with the objective of developing understanding of the students about the essence of Indian traditional knowledge in terms of its scientific approach, legality, role in natural resource protection, as well as its contribution to philosophy and art.

### Course outcome

Students will have increased ability to understand the importance and application of:

CO1: Indian Knowledge system and its scientific approach

CO2: Indian philosophical tradition

CO3: Indian artistic tradition

CO4: Traditional knowledge and protection of nature

CO5: The legality and its importance for the protection of Indian traditional knowledge

### Syllabus

1. Basic Structure of Indian Traditional Knowledge: Vedas, Upavedas, Vedang, Upadang, scientific approach
2. Ecology and Indian Traditional Knowledge: Meaning, role, case studies
3. Intellectual Property Rights and Indian traditional Knowledge: Meaning, role in protection of Indian traditional knowledge, cases studies
4. Indian Philosophical traditions: Nyay, Sankaya, Yog, Mimansa, Jainism, Buddhism, Sikhism, and other approaches
5. Indian Artistic Traditions: Chitrakala, Murtikala, Vastukala, Sangeet, Sthpatya, Nrityaevam Sahitya, case studies

### Reference Material

1. RR Gaur, Rajeev Sangal, GP Bagaria, Human Values and Professional Ethics (Excel Books, New Delhi, 2010)
2. V. Sivaramakrishanan (ed.), Cultural Heritage of India – Course material, Bharatiya VidyaBhavan, Mumbai, 5th Edition, 2014
3. Swami Jitatmanand, Modern Physics and Vedant, BharatiyaVidyaBhavan
4. Swami Jitatmanand, Holistic Science and Vedant, BharatiyaVidyaBhavan
5. S.C. Chatterjee and D.M. Datta, An introduction to Indian Philosophy, University of Calcutta, 1984
6. Pramod Chandra, Indian Arts, Howard University Press, 1984
7. Krishna Chaitanya, Arts of India, Abhinav Publications, 1987

## Syllabus for Semester III, BE Computer Science & Engineering (Data Science)

**Course Code : HUT253** **Course : Business Communications**

**L: 3 Hrs, T: 0 Hr, P: 0 Hr, Per Week** **Total Credits : 3**

### Course Objective

The course aims to develop the skills of students of writing effective business documents and applying effective strategies of verbal business communication

### Course Outcome

On completion of the course, students will be able to achieve the following:

**CO1:** Understand the fundamentals and objectives of business communication, and role of audience in effective communication.

**CO2:** Develop technical writing skills and produce effective workplace documents.

**CO3:** Apply the rules of English grammar in writing.

**CO4:** Develop skills to enhance visual appeal of documents.

**CO5:** Evaluate and apply strategies for effective oral communication for professional needs.

### Syllabus

**Unit - I : Fundamentals of Business Communication**

Definition of communication and business communication, Objectives of Business Communication, Audience recognition, Barriers of Communication, Product Promotion, Usage of Social Media, Negotiation Skills, Persuasive Communication, PAC concept

**Unit - II : Technical Writing :**

Process of Technical Writing, Letters: Job application, Job Description and Resume, enquiry, complaint, order, follow-up, cover/transmittal letters, Sales Letters, and e-mails. Other Forms of Technical Writing: Organizational announcements, Notices, Agenda, Minutes of Meeting, Memorandums.

**Unit - III : Grammar for Writing**

Punctuations, Mechanics, Active/ Passive, Transformation of Sentences, Subject-Verb Agreement, Articles, Prepositions

**Unit - IV : Business Reports**

Basic formats and types - Annual, Progress, Project (Project Charter, Project Timeline), Market Search, Sales, Feasibility/Recommendation, Case Study evaluation.

**Unit - V : Preparation of Documents**

**Visual Appeal :** Document Design, Graphics, Tables, User Manuals, Brochures, Fliers

**Unit - VI : Effective Oral Communication**

Non- Verbal Communication, Presentation and Public speaking, Group Discussion

## Books

1. Sharon Gerson, Steven Gerson, "Technical Communication: Process and Product", 2018, Pearson
2. Sanjay Kumar, Pushpa Lata, Communication Skills, 2nd Edition, Oxford Publication, 2018.
3. Shalini Verma, Business Communication, Vikas Publishing House Pvt. Ltd., 2015.
4. P.D. Chaturvedi and Mukesh Chaturvedi, Fundamentals of Business Communication, Pearson Publications, 2012.
5. William Strunk Jr. and E.B. White The Elements of Style, Allyn& Bacon 'A Pearson Education Company', 2000.

## Syllabus for Semester III, BE Computer Science & Engineering (Data Science)

**Course Code : HUT257** **Course : Cyber Law and Ethics in IT**

**L: 2 Hrs, T: 0 Hr, P: 0 Hr, Per Week** **Total Credits : 2**

### Course Objectives

1. Describe laws governing cyberspace and analyze the role of Internet Governance in framing policies for Internet security
1. Identify intellectual property right issues in the cyberspace and design strategies to protect your intellectual property
3. Understand the importance of freedom of expression, defamation and hate speech in Cyber world.
4. Recognize the importance of digital divide, contingent workers and whistle blowing situations.

### SYLLABUS

**UNIT - I**

Cyber laws and rights in today's digital age; IT Act, Intellectual Property Issues connected with use and management of Digital Data, Emergence of Cyberspace, Cyber Jurisprudence.

**UNIT - II**

Cyber Crimes against Individuals, Institution and State, Hacking, Digital Forgery, Cyber Stalking / Harassment, Cyber terrorism, Cyber Defamation, Different offences under IT Act, 2000,Cyber Torts.

**UNIT - III**

Ethics in business world, Ethic s in IT, Ethics for IT professionals and IT users, IT professional malpractices, communications eavesdropping, computer break-ins, denial-of-service, destruction and modification of data, distortion and fabrication of information, Types of Exploits and Perpetrators.

**UNIT - IV**

**Intellectual Property :** Copy rights, Patents, Trade Secret Laws, Key Intellectual property issues, Plagiarism, Competitive Intelligence, Cybers quatting, Information warfare policy and ethical Issues.

**UNIT - V**

**Privacy :** The right of Privacy, Protection, Key Privacy and Anonymity issues, Identity Theft, Consumer Profiling, Defamation, Freedom of Expression, Anonymity, National, Security Letters, Defamation and Hate Speech.

**UNIT - VI**

Ethics of IT Organization: Contingent Workers H- IB Workers, Whistle- blowing, Protection for Whistle- Blowers, Handling Whistle- blowing situation, Digital divide.

## Course Outcomes

On successful completion of the course, students will be able

1. To identify and analyze statutory, regulatory, constitutional, and organizational laws that affects the software professional.
2. To understand carious cyber laws with respect to legal dilemmas in the Information Technology field.
3. To interpret various intellectual property rights, Privacy, Protection issues in software development field.
4. To understand role of ethics in IT organization.

## Text Books

1. George Reynolds, "Ethic s in information Technology",5th edition, Cengage Learning
2. Hon C Graff, Cryptography and E-Commerce - A Wiley Tech Brief, Wiley Computer Publisher, 2001.

## Reference Books

1. Michael Cross, Norris L Johnson, Tony Piltzecker, Security, Shroff Publishers and Distributors Ltd.
2. Debora Johnson," Computer Ethic s",3/e Pearson Education.
3. Sara Baase, "A Gift of Fire: Social, Legal and Ethical Issues, for Computing and the Internet," PHI Public at ions.
4. Chris Reed & John Angel, Computer Law, OUP, New York, (2007).

## Syllabus for Semester IV, BE Computer Science & Engineering (Data Science)

**Course Code : CDT206** **Course : Artificial Intelligence**

**L: 3 Hrs, T: 0 Hr, P: 0 Hr, Per Week** **Total Credits : 3**

### Course Objectives

1. To understand challenges involved in designing intelligent systems.
2. To represent given problem using state space representation and solve it by using different search techniques.
3. To understand knowledge representation methods using logic programming.
4. To understand uncertainty theory in designing AI systems.

### Syllabus

**UNIT - I**

**Introduction :** Basics of problem solving, problem representation (toy problems and real world problems); Structure of agent, rational agent, Specifying task environment, Properties of task environment; measuring problem-solving performance

**UNIT - II**

**Uninformed search techniques :** Depth, Breadth, Uniform Cost, Depth Limited, Iterative deepening DFS, Bidirectional Search

**UNIT - III**

**Informed search techniques :** Heuristic Based Search, Greedy Best First Search, A* Search; Local Search algorithms: Hill-climbing, Simulated Annealing, Genetic Algorithms.

**UNIT - IV**

**Adversarial Search :** Two player Games, The min-max algorithm, Alpha-Beta pruning. Constraint Satisfaction Problems: Constraint propagation, backtracking search

**UNIT - V**

**Propositional Logic :** Inference, Equivalence, Validity and satisfiability, Resolution, Forward and Backward Chaining, First Order Logic: Syntax and Semantics of FOL, Inference in FOL, Unification, Forward Chaining, Backward Chaining, and Resolution.

**UNIT - VI**

**Uncertainty Knowledge and Reasoning :** Probability and Baye's Theorem, Statistical reasoning: Bayesian networks, Naïve Bayes algorithm, Fuzzy Logic, Introduction to expert system

## Course Outcomes

On successful completion of the course, students will be able to:

1. Represent given problem using state space representation and apply uninformed and informed search techniques on it.
2. Solve the fully informed two player games using different AI techniques.
3. Solve the AI problems by using logic programming
4. Apply uncertainty theory based on techniques like probability theory and fuzzy logic.

## Text Book

1. Stuart Russel and Peter Norvig; Artificial Intelligence: A Modern Approach; Third Edition; Pearson Education, 2009.

## Reference Books

1. E. Rich, K. Knight, S. B. Nair; Artificial Intelligence; 3rd Edition; Tata McGraw Hill, 2014.
2. Denis Rothman; Artificial Intelligence By Example: Develop machine intelligence from scratch using real artificial intelligence use cases; Kindle Edition, Packt Publishing Ltd, 2018.

## Syllabus for Semester IV, BE Computer Science & Engineering (Data Science)

**Course Code : CDT207** **Course : Operating Systems**

**L: 3 Hrs, T: 0 Hr, P: 0 Hr, Per Week** **Total Credits : 3**

### Course Objectives

1. The course focuses on developing a fundamental knowledge of operating systems.
2. The course targets at the detail understanding of the basic tasks such as scheduling, memory management and file system management
3. It also covers the complex concepts of inter process communication and deadlocks.

### SYLLABUS

**Unit - I**

**Introduction :** Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS - Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine, Case study on LINUX and Windows Operating System.

**Unit - II**

**Processes :** Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching.

**Threads :** Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads.

**Process Scheduling :** Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SRTF, Priority, RR, Case study on Process Management in LINUX Operating System.

**Unit - III**

**Inter-process Communication :** Critical Section, Race Conditions, Mutual Exclusion, Peterson's solution, Hardware Solution, Semaphores, Monitors, Message Passing, Classical IPC Problems: Producer-Consumer Problem, Reader-Writer Problem, Dinning Philosopher Problem etc.

**Unit - IV**

**Deadlocks :** Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

**Unit - V**

**Memory Management :** Basic concept, Logical and Physical address mapping, Memory allocation: Contiguous Memory allocation – Fixed and variable partition, Internal and External fragmentation and Compaction, Paging: Principle of operation – Page allocation, Hardware support for paging, Protection and sharing, Advantages & Disadvantages of paging.

**Virtual Memory :** Basics of Virtual Memory, Hardware and control structures, Locality of reference, Page fault, Working Set, Dirty page/ Dirty bit, Demand paging; Page Replacement algorithms: First in First Out (FIFO), Least Recently used (LRU), and Optimal.

**Unit - VI**

**File Management :** Concept of File, Access methods, File types, File operations, Directory structure, File System structure, Allocation methods, Free-space management.

**Disk Management :** Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, LOOK, C-LOOK, Disk reliability, Disk formatting, Boot block, Bad blocks, case study on File Systems in LINUX operating System.

## Course Outcomes

On successful completion of the course, students will be able to:

1. Describe and Classify differing structures for operating systems.
2. Understand the role of various components (process, memory, file systems, etc.) of operating system.
3. Analyze and apply resource (CPU, Memory, Disk) management policies.
4. Determine challenges in inter process communication and design solutions for it.

## Text Books

1. Operating System Concepts, 8th Edition by A. Silberschatz, P.Galvin, G. Gagne, Wiley India Edition.
2. Modern Operating Systems, 2nd Edition by Andrew Tanenbaum, PHI.

## Reference Books

1. Operating Systems: Internals and Design Principles, 5th Edition, William Stallings, Prentice Hall of India.
2. Understanding the Linux Kernel, 3rd Edition, Daniel P. Bovet, Marco Cesati, O'Reilly.

## Syllabus for Semester IV, BE Computer Science & Engineering (Data Science)

**Course Code : CDP207** **Course : Operating Systems Lab**

**L: 0 Hrs, T: 0 Hr, P: 4 Hr, Per Week** **Total Credits : 2**

### Course Objectives

Using C language in Linux environment

1. To develop ability of students to design and implement concepts of operating systems such as system calls, CPU scheduling, process/thread management.
2. To develop the components and management aspects of concurrency management, memory management, and File management.

### SYLLABUS

Experiments based on CDT207 Syllabus.

### Course Outcomes

On completion of the course, the student will be able to :

1. Demonstrate LINUX system calls and implement system commands.
2. Implement process and process schedulers.
3. Design and implement solution to handle synchronization and deadlock.
4. Implement memory and File management algorithms.

## Syllabus for Semester IV, BE Computer Science & Engineering (Data Science)

**Course Code : CDT208** **Course : Database Management Systems**

**L: 3 Hrs, T: 0 Hr, P: 0 Hr, Per Week** **Total Credits : 3**

## Course Objectives

1. To understand the role of a database management system in an organization.
2. To construct simple and advanced database queries using a data language.
3. To understand and apply logical database design principles and database normalization.
4. To recognize the need for transaction management and query processing.

## SYLLABUS

### UNIT - I

Databases and Database Users, Characteristics of the Database Approach, Advantages of Using the DBMS Approach, When Not to Use a DBMS, Data Models, Schemas, and Instances, Three-Schema Architecture and Data Independence, Database Languages and Interfaces, The Database System Environment. Introduction to NoSQL databases and In-Memory databases.

### UNIT - II

Relational Model Concepts, Relational Model Constraints and Relational Database Schemas, Update Operations, Transactions, and Dealing with Constraint Violations, SQL Data Definition, Data Types and Constraints, Data Management in SQL, Transforming ER Model into Relational Model.

### UNIT : III : Database Design and Normalization

Functional Dependencies, Inference Rules, Equivalence, and Minimal Cover, Properties of Relational Decomposition, Normal Forms Based on Primary Keys, General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form, Other Dependencies and Normal Forms.

### UNIT - IV : Indexing and Hashing

Ordered Indices, B+-Tree Index Files and its Extensions, Static Hashing and Dynamic Hashing, Comparison of Ordered Indexing and Hashing, Bitmap Indices, Some General Issues Concerning Indexing.

### UNIT - V : Query Processing and Optimization

Measures of Query Cost, Query Operation: Selection, Sorting and Join Operation, Transformation of Relational Expressions, Estimating Statistics of Expression Results, Choice of Evaluation Plans.

**UNIT - VI : Transaction Processing, Concurrency Control and Recovery**

Introduction to Transaction Processing, Characterizing Schedules Based on Recoverability, Characterizing Schedules Based on Serializability, Two-Phase Locking Techniques for Concurrency Control, Deadlock Handling and Multiple Granularity, Database Recovery Techniques.

## Course Outcomes

On completion of the course the student will be able to

1. Identify the basic concepts and various data model used in database design.
2. Recognize the use of normalization and functional dependency.
3. Understand the purpose of query processing and optimization.
4. Apply and relate the concept of transaction, concurrency control and recovery in database.

## Text Books

1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan; "Database System Concepts"; Sixth Edition, Tata McGraw Hill, 2011.
2. Ramez Elmasri and Shamkant Navathe; "Fundamentals of Database Systems"; Sixth Edition, Addison Wesley 2011.

## Reference Books

1. Raghu Ramakrishnan and Johannes Gehrke; "Database Management Systems"; Third Edition, Tata McGraw Hill Publication, 2003.
2. C. J. Date; "Database in Depth – Relational Theory for Practitioners"; O` Reilly Media, 2005

## Syllabus for Semester IV, BE Computer Science & Engineering (Data Science)

**Course Code : CDP208** **Course : Database Management Systems Lab**

**L: 0 Hrs, T: 0 Hr, P: 4 Hr, Per Week** **Total Credits : 2**

### Course Objectives

1. To enable students to use DDL, DML and DCL.
2. To prepare students to conceptualize and realize database objects (tables, indexes, views and sequences) and execute SQL queries.
3. To encourage students to design and execute PL/SQL blocks and triggers.

### SYLLABUS

Experiments based on CDT208 Syllabus in Oracle 11g | MySQL.

[Few experiments to be conducted to demonstrate handling of databases on cloud, Few experiments to be conducted on no SQL]

### Course Outcomes

On completion of the course the student will be able to

1. Understand the use of database languages such as DDL, DML, and DCL.
2. Construct simple, nested, multiple table, and advanced queries for data retrieval.
3. Construct PL-SQL block structure and Trigger for specific application.
4. Implement various integrity constraints, views, sequences, indices and synonym on database.

### Reference Books

1. James Groff, Paul Weinberg and Andy Oppel, SQL - The Complete Reference, 3rd Edition, McGraw Hill, 2017.

## Syllabus for Semester IV, BE Computer Science & Engineering (Data Science)

**Course Code : CDT209** **Course : Theory of Computation**

**L: 3 Hrs, T: 0 Hr, P: 0 Hr, Per Week** **Total Credits : 3**

## Course Objectives

1. To provide students an understanding of basic concepts in the theory of computation.
2. To teach formal languages and various models of computation.
3. To exhibit fundamental concepts related with computability theory.

## SYLLABUS

### UNIT - I

Basics of Sets and Relation, Countability and Diagonalisation, Principle of mathematical induction, Pigeon-hole principle. Fundamentals of formal languages and grammars, Chomsky hierarchy of languages.

### UNIT - II

**Finite automata :** Deterministic finite automata (DFA), Nondeterministic finite automata (NFA) and equivalence with DFA, Minimization of finite automata, NFA with Epsilon Transitions, Finite Automata with output.

### UNIT - III

Regular expressions and Regular languages, Regular grammars and equivalence with finite automata, properties of regular languages, pumping lemma for regular languages, Context-free grammars (CFG) and language(CFL), parse trees, ambiguity in CFG, Reduction of CFGs, Chomsky and Greibach normal forms.

### UNIT - IV

Push Down Automata: Deterministic pushdown automata and Non-Deterministic pushdown automata, Acceptance by two methods: Empty stack and Final State, Equivalence of PDA with CFG, closure properties of CFLs.

### UNIT - V

**Turing machines:** The basic model for Turing machines (TM), Turing recognizable recursivelye numerable) and Turing-decidable (recursive) languages, variants of Turing machines, unrestricted grammars and equivalence with Turing machines, TMs as enumerators.

### UNIT - VI

**Undecidability:** Church-Turing thesis, Universal Turing machine, Undecidable problems about languages, Recursive Function Theory.

## Course Outcomes

On successful completion of the course, students will be able to demonstrate

1. Describe the formal relationships among machines, languages and grammars.
2. Design and Optimize finite automata for given regular languages.
3. Design Pushdown Automata, Turing Machine for given languages.
4. Demonstrate use of computability, decidability, recursive function theory through problem solving.

## Text Books

1. John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, Introduction to Automata Theory, Languages, and Computation, Pearson Education Asia.

## Reference Books

1. Harry R. Lewis and Christos H. Papadimitriou, Elements of the Theory of Computation, Pearson Education Asia.
2. Dexter C. Kozen, Automata and Computability, Undergraduate Texts in Computer Science, Springer.
3. Michael Sipser, Introduction to the Theory of Computation, PWS Publishing.
4. John Martin, Introduction to Languages and The Theory of Computation, Tata McGraw Hill

## Syllabus for Semester IV, BE Computer Science & Engineering (Data Science)

**Course Code : CDT210** **Course : Computer Network**

**L: 3 Hrs, T: 0 Hr, P: 0 Hr, Per Week** **Total Credits : 3**

## Course Objectives

1. To develop an understanding of modern network architectures from a design and performance perspective.
2. To introduce the student to the major concepts involved in network protocols.
3. To provide an opportunity to do network programming

## SYLLABUS

**UNIT - I**

Data communication Components: Representation of data and its flow Networks, VariousConnection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division

**UNIT - II**

**Data Link Layer :** Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ.

**UNIT - III**

**Medium Access Sub Layer :** Switching, Random Access, Multiple access protocols - Pure ALOHA, Slotted ALOHA, CSMA/CD, CDMA/CA, IEEE 802 standard protocols.

**UNIT - IV**

**Network Layer :** Internet Protocol (IP) – Logical Addressing: IPV4, IPV6; Address mapping: ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols.

**UNIT - V**

**Transport Layer :** Elements of Transport protocols: Addressing, Connection establishment, Connection release, Crash recovery, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), TCP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.

**UNIT - VI**

**Application Layer :** Socket Interface and Socket programming , Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP),WWW, HTTP.

## Course Outcomes

On successful completion of the course, students will be able to:

1. Understand basics of computer networks and reference models
2. Identify the Design issues of each layer of OSI model
3. Implement the protocols of OSI model

## Text Books

1. Computer Networks: 5th ed by Andrew. S. Tanenbaum. PHI Publication.
2. Data Communications and Networks: 3rd ed by Behrouz A. Forouzan. Tata McGraw Hill publication.

## Reference Books

1. James F. Kurose and Keith W. Ross: Computer Networking: A Top-Down Approach Featuring the Internet, 3rd Edition.
2. William Stallings, "Data and Computer Communications", PHI 6th Edition

## Syllabus for Semester IV, BE Computer Science & Engineering (Data Science)

**Course Code : CDP211** **Course : Data Handling and Visualization Lab**

**L: 0 Hrs, T: 0 Hr, P: 4 Hr, Per Week** **Total Credits : 2**

### Course Objectives

The course aims to familiarize the students with the process of gathering data, transforming data, and presenting it in a way that is meaningful to others.

### SYLLABUS

Experiments may include, but are not limited to the following :

- Extract data from different sources like text files, APIs, databases.
- Data cleaning techniques
- Data processing techniques
- Data loading techniques
- Data visualization techniques like plots (line plot, scatter plot, etc), charts (bar charts, pie chart, donut chart, etc) , histograms, Box and Whisker Plot, Maps, Word Clouds, Network diagrams, Correlation Matrices, etc

### Course Outcomes

On completion of the course the student will be able to

1. Perform data extraction.
2. Understand and apply different data transformation and loading techniques.
3. Identify and apply appropriate data visualization technique(s).

### Reference Books

1. Claus O. Wilke, "Fundamentals of Data Visualization – A Primer on Making Informative and Compelling Figures", O'Reilly, 2019.
2. Kyran Dale, "Data Visualization with Python and JavaScript – Scrape, Clean and transform Your Data", O'Reilly, 2016.

## Syllabus for Semester IV, BE Computer Science & Engineering (Data Science)

**Course Code : CHT252** **Course : Environmental Sciences**

**L: 2 Hrs, T: 0 Hr, P: 0 Hr, Per Week** **Total Credits : 0**

## SYLLABUS

**UNIT - I**

**Air pollution and its control techniques: (4 lectures)**

Contaminant behaviour in the environment, Air pollution due to SOx, NOx, photochemical smog, Indoor air pollution Natural pathways for degradation: Carbon cycle, Sulphur cycle, Nitrogen cycle, Oxygen cycle Factors responsible for altering the composition of atmosphere (deforestation, burning of fossil fuels, industrial and vehicular emissions, CFCs). Techniques to control Air pollution, ambient air quality and continuous air quality monitoring, Control measures at source, Kyoto Protocol, Carbon Credits.

**UNIT - II**

**Noise pollution and its control techniques: (2 lectures)**

Introduction to noise pollution and its causes. Noise pollution control: Recent advances in noise pollution control and benefits.

**UNIT - III**

**Soil pollution and its control techniques: (5 lectures)**

**Soil pollution :** Soil around us, Soil water characteristics, soil pollution.

**Solid waste management :** Composting, vermiculture, landfills, hazardous waste treatment, bioremediation technologies, conventional techniques (land farming, constructed wetlands),and phytoremediation. Degradation of xenobiotics in environment: Petroleum hydrocarbons, pesticides, heavy metals

**UNIT - IV**

**Water pollution and its control techniques: (8 lectures)**

**Major sources of water pollution :** Eutrophication, acid mine drains, pesticides and fertilizers,dyeing and tanning, marine pollution, microplastics Techniques to control water pollution: Conventional waste water treatment-types of sewage, sewerage system, alternative systems, primary, secondary and tertiary processes including aerobic and anaerobic techniques, safe disposal. Case studies: Treatment schemes for waste water from dairy, textile, power plants,pharmaceutical industries, and agro based industries such as rice mills.

**UNIT - V**

**E-wastes (2 lectures)**

Introduction, types of e-wastes, environmental impact, e-waste recycling, e-waste management rules.

**Unit - VI**

**Environmental Sustainability:** Role of Green technology (5 lectures)

Concept of green technologies, categories, goals and significance, sustainability Green energy, green chemistry, challenges to green technology, advantage and disadvantages of green processes, Eco mark certification- its importance and implementation VII- Different government initiatives (2 lectures) National ambient air quality standard 2009, Swacch Bharat Abhiyan, National afforestation program and Act- 2016, National river conservation plan, Formation of National Green Tribunal

## Course Outcomes

On successful completion of the course, students

1. Will get sufficient knowledge regarding different types of environmental pollutions, their causes, detrimental effects on environment and effective control measures.
2. Will realize the need to change an individual's outlook, so as to perceive our Environmental issues correctly, using practical approach based on observations and self-learning.
3. Will become conversant with recent waste management techniques such as E-wastes, itsrecycling and management.
1. Will gain knowledge about the modes for sustainable development, importance of green energy and processes.
2. Will be able to identify and analyze environmental problems as well as risks associated with these problems and greener efforts to be adopted, to protect the environment from getting polluted.

## Suggested Books

1. Benny Joseph, Environmental Studies, McGraw Hill Education (India) Private Limited
2. B. K. Sharma, Environmental Chemistry, Goel Publishing House, Meerut
3. P Aarne Vesilind, J. Jeffrey Peirce and Ruth F. Weiner, Environmental Pollution and Control, Butterworth-Heinemann
4. D. D. Mishra, S. S. Dara, A Textbook of Environmental Chemistry and Pollution Control, S. Chand & Company Ltd. Sultan Chand & Company
5. Shree Nath Singh, Microbial Degradation of Xenobiotics, Springer-Verlag Berlin Heidelberg
6. P.T. Anastas& J.C. Warner, Green Chemistry: Theory & practice, Oxford University Press.
7. P. Thangavel&Sridevi, Environmental Sustainability: Role of Green technologies, Springer publications.

# NOTES