# SENGUNTHAR ENGINEERING COLLEGE

(AUTONOMOUS)

(Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai)
Recognized Under Section 2(f) & 12(B) of the UGC Act, 1956
NAAC Accredited with 'A' Grade
TIRUCHENGODE - 637 205 NAMAKKAL (Dt) TAMILNADU

ESTD 2001

ISO 9001 REGISTERED

# CURRICULUM & SYLLABI

# B.Tech. ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

(CHOICE BASED CREDIT SYSTEM)

# REGULATIONS – 2019

# (Revised)

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# B.Tech. ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

(CHOICE BASED CREDIT SYSTEM)

## REGULATIONS – 2019

## (Revised)

Note: The regulations hereunder are subject to amendments as may be decided by the Academic Council of the Sengunthar Engineering College from time to time. Any or all such amendments will be effective from such date and to such batches of candidates (including those already undergoing the program) as may be decided by the Academic Council.

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## CURRICULUM AND SYLLABI

## FOR B.E. / B.Tech. DEGREE PROGRAMMES

## (For the Students Admitted in the Academic Year 2022-2023 onwards)

## B.Tech. - ARTIFICIAL INTELLIGENCE AND DATA SCIENCE - FIRST SEMESTER

| Course Code | Name of the Subject | Category | Periods / Week | | | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | C | CIA | ESE | TOT |
| 19HST101 | Communicative Techno English - I | HS | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 19MAT101 | Engineering Mathematics - I | BS | 3 | 1 | 0 | 4 | 40 | 60 | 100 |
| 19CYE101 | Engineering Chemistry | BS | 3 | 0 | 2 | 4 | 50 | 50 | 100 |
| 19PHE101 | Engineering Physics | BS | 3 | 0 | 2 | 4 | 50 | 50 | 100 |
| 19GET101 | Engineering Graphics | ES | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 19GEE101 | Computer Fundamentals and Python Programming | ES | 3 | 0 | 2 | 4 | 50 | 50 | 100 |
| 19EEC101 | Life Skills for Engineers | EEC | 0 | 0 | 2 | 0 | 100 | - | 100 |
| 19MDC101 | Induction Program ( 2 Weeks ) | MC | - | - | - | - | - | - | - |
| TOTAL CREDITS IN SEMESTER - I | | | 22 | | | | | | |

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## B.Tech. - ARTIFICIAL INTELLIGENCE AND DATA SCIENCE - SECOND SEMESTER

| Course Code | Name of the Subject | Category | Periods / Week | | | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | C | CIA | ESE | TOT |
| 19HST201 | Communicative Techno English - II | HS | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 19CYT201 | Environmental Science and Engineering | BS | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 19MAT201 | Engineering Mathematics - II | BS | 3 | 1 | 0 | 4 | 40 | 60 | 100 |
| 19PHT202 | Solid State Physics and Nano Electronic Devices | BS | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 19GET201 | Fundamentals of Electrical Electronics and Instrumentation | ES | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 19CSE201 | C Programming | PC | 3 | 0 | 2 | 4 | 50 | 50 | 100 |
| 19EEC202 | Technical Skill (Multimedia) | EEC | 0 | 0 | 2 | 0 | 100 | - | 100 |
| 19MDC201 | NSS / YRC / RRC | MC | - | - | - | - | 100 | - | 100 |
| TOTAL CREDITS IN SEMESTER - II | | | 20 | | | | | | |

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## B. Tech. - ARTIFICIAL INTELLIGENCE AND DATA SCIENCE - THIRD SEMESTER

| Course Code | Name of the Subject | Category | Periods / Week | | | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | C | CIA | ESE | TOT |
| 19MAT301 | Transforms and Partial Differential Equations | BS | 3 | 1 | 0 | 4 | 40 | 60 | 100 |
| 19CST301 | Data Structures | PC | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 19ADT301 | Fundamentals of Artificial Intelligence | PC | 3 | 1 | 0 | 4 | 40 | 60 | 100 |
| 19ECE304 | Digital Principles and Computer Architecture | ES | 3 | 0 | 2 | 4 | 50 | 50 | 100 |
| 19CSE401 | Database Management Systems | PC | 3 | 0 | 2 | 4 | 50 | 50 | 100 |
| 19ADE301 | Java Programming | PC | 3 | 0 | 2 | 4 | 50 | 50 | 100 |
| 19EEC301 | Communication Skills | EEC | 0 | 0 | 2 | 0 | 100 | - | 100 |
| 19MDC301 | Leadership Enhancement Programme | MC | - | - | - | - | 100 | - | 100 |
| TOTAL CREDITS IN SEMESTER - III | | | 23 | | | | | | |

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## B. Tech. - ARTIFICIAL INTELLIGENCE AND DATA SCIENCE - FOURTH SEMESTER

| Course Code | Name of the Subject | Category | Periods / Week | | | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | C | CIA | ESE | TOT |
| 19MAT406 | Essential of Mathematics for Machine Learning | BS | 3 | 1 | 0 | 4 | 40 | 60 | 100 |
| 19CST401 | Design and Analysis of Algorithms | PC | 3 | 1 | 0 | 4 | 40 | 60 | 100 |
| 19CST402 | Operating Systems | PC | 3 | 1 | 0 | 4 | 40 | 60 | 100 |
| 19CST403 | Software Engineering | PC | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 19ADE401 | Fundamentals of Data Science and Analytics | PC | 3 | 0 | 2 | 4 | 50 | 50 | 100 |
| 19ADE402 | Machine Learning | PC | 3 | 0 | 2 | 4 | 50 | 50 | 100 |
| 19EEC302 | Entrepreneurship Development Activity | EEC | 0 | 0 | 2 | 0 | 100 | - | 100 |
| 19MDC401 | Value Added Course – I | MC | - | - | - | - | 100 | - | 100 |
| TOTAL CREDITS IN SEMESTER - IV | | | 23 | | | | | | |

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## B. Tech. - ARTIFICIAL INTELLIGENCE AND DATA SCIENCE - FIFTH SEMESTER

| Course Code | Name of the Subject | Category | Periods / Week | | | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | C | CIA | ESE | TOT |
| 19ADT501 | Deep Learning | PC | 3 | 1 | 0 | 4 | 40 | 60 | 100 |
| 19ADT502 | Business Intelligence | PC | 3 | 1 | 0 | 4 | 40 | 60 | 100 |
| 19CSPX26 | Optimization Techniques | PC | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 19CSE501 | Computer Networks | PC | 3 | 0 | 2 | 4 | 50 | 50 | 100 |
| 19ADE501 | Data Analytics | PC | 3 | 0 | 2 | 4 | 50 | 50 | 100 |
| 19MGT501 | Engineering Economics and Management | HS | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 19EEC501 | Quantitative Aptitude Learning | EEC | 0 | 2 | 0 | 0 | 100 | - | 100 |
| 19MDC501 | Value Added Course – II | MC | - | - | - | - | 100 | - | 100 |
| TOTAL CREDITS IN SEMESTER - V | | | 22 | | | | | | |

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## B. Tech. - ARTIFICIAL INTELLIGENCE AND DATA SCIENCE - SIXTH SEMESTER

| Course Code | Name of the Subject | Category | Periods / Week | | | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | C | CIA | ESE | TOT |
| 19ADT601 | CryptAnalysis and Network Security | PC | 3 | 1 | 0 | 4 | 40 | 60 | 100 |
| 19CSPX08 | Natural Language Processing | PC | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 19ADE601 | IoT and its Applications | PC | 3 | 0 | 2 | 4 | 50 | 50 | 100 |
| 19ADE602 | Data Visualization | PC | 3 | 0 | 2 | 4 | 50 | 50 | 100 |
| | Professional Elective – I | PE | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| | Open Elective – I | OE | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 19ADJ601 | Mini Project | EEC | 0 | 0 | 2 | 1 | 100 | - | 100 |
| 19MDC601 | Constitution of India | MC | 3 | - | - | - | 100 | - | 100 |
| TOTAL CREDITS IN SEMESTER - VI | | | 22 | | | | | | |

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TOT : Total

## B. Tech. - ARTIFICIAL INTELLIGENCE AND DATA SCIENCE - SEVENTH SEMESTER

| Course Code | Name of the Subject | Category | Periods / Week | | | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | C | CIA | ESE | TOT |
| 19ADE701 | Computer Vision | PC | 3 | 0 | 2 | 4 | 50 | 50 | 100 |
| 19CSPX14 | Software Project Management | PC | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 19CSE702 | Cloud Computing | PC | 3 | 0 | 2 | 4 | 50 | 50 | 100 |
| | Professional Elective – II | PE | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 19ADJ701 | Project Work (Phase - I) | EEC | 0 | 0 | 2 | 1 | 40 | 60 | 100 |
| TOTAL CREDITS IN SEMESTER - VII | | | 15 | | | | | | |

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## B. Tech. - ARTIFICIAL INTELLIGENCE AND DATA SCIENCE - EIGHTH SEMESTER

| Course Code | Name of the Subject | Category | Periods / Week | | | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | C | CIA | ESE | TOT |
| | Professional Elective - III | PE | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| | Open Elective - II | OE | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 19ADJ801 | Project Work (Phase - II) | EEC | 0 | 0 | 20 | 10 | 40 | 60 | 100 |
| TOTAL CREDITS IN SEMESTER - VIII | | | 16 | | | | | | |

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PC : Professional Core
PE : Professional Elective
OE : Open Elective
EEC : Employability Enhancement Courses
MC : Mandatory Courses
L : Lecture
T : Tutorial
P : Practical
C : Credit Point
CIA : Continuous Internal Assessment
ESE : End Semester Examination
TOT : Total

## LIST OF PROFESSIONAL CORE (PC) COURSES

| Course Code | Name of the Subject | Category | Hours / Week | | | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | C | CIA | ESE | TOT |
| 19CSE201 | C Programming | PC | 3 | 0 | 2 | 4 | 50 | 50 | 100 |
| 19CST301 | Data Structures | PC | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 19ADT301 | Fundamentals of Artificial Intelligence | PC | 3 | 1 | 0 | 4 | 40 | 60 | 100 |
| 19CSE401 | Database Management Systems | PC | 3 | 0 | 2 | 4 | 50 | 50 | 100 |
| 19ADE301 | Java Programming | PC | 3 | 0 | 2 | 4 | 50 | 50 | 100 |
| 19CST401 | Design and Analysis of Algorithms | PC | 3 | 1 | 0 | 4 | 40 | 60 | 100 |
| 19CST402 | Operating Systems | PC | 3 | 1 | 0 | 4 | 40 | 60 | 100 |
| 19CST403 | Software Engineering | PC | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 19ADE401 | Fundamentals of Data Science and Analytics | PC | 3 | 0 | 2 | 4 | 50 | 50 | 100 |
| 19ADE402 | Machine Learning | PC | 3 | 0 | 2 | 4 | 50 | 50 | 100 |
| 19ADT501 | Deep Learning | PC | 3 | 1 | 0 | 4 | 40 | 60 | 100 |
| 19ADT502 | Business Intelligence | PC | 3 | 1 | 0 | 4 | 40 | 60 | 100 |
| 19CSPX26 | Optimization Techniques | PC | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 19CSE501 | Computer Networks | PC | 3 | 0 | 2 | 4 | 50 | 50 | 100 |
| 19ADE501 | Data Analytics | PC | 3 | 0 | 2 | 4 | 50 | 50 | 100 |
| 19ADT601 | CryptAnalysis and Network Security | PC | 3 | 1 | 0 | 4 | 40 | 60 | 100 |
| 19CSPX08 | Natural Language Processing | PC | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 19ADE601 | IoT and its Applications | PC | 3 | 0 | 2 | 4 | 50 | 50 | 100 |
| 19ADE602 | Data Visualization | PC | 3 | 0 | 2 | 4 | 50 | 50 | 100 |
| 19ADE701 | Computer Vision | PC | 3 | 0 | 2 | 4 | 50 | 50 | 100 |
| 19CSPX14 | Software Project Management | PC | 3 | 0 | 2 | 4 | 40 | 60 | 100 |
| 19CSE702 | Cloud Computing | PC | 3 | 0 | 2 | 4 | 50 | 50 | 100 |

## LIST OF PROFESSIONAL ELECTIVE (PE) COURSES

| Course Code | Name of the Subject | Category | Hours / Week | | | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | C | CIA | ESE | TOT |
| **Professional Elective – I** | | | | | | | | | |
| 19ADPX01 | R Programming | PE | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 19ADPX02 | Knowledge engineering | PE | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 19ADPX03 | Microprocessor and Microcontroller | PE | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 19ADPX04 | Mobile Application Development | PE | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 19CSPX16 | Semantic Web | PE | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 19CSPX23 | Soft Computing | PE | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| **Course Code** | **Name of the Subject** | **Category** | **Hours / Week** | | | **Credit** | **Maximum Marks** | | |
| | | | **L** | **T** | **P** | **C** | **CIA** | **ESE** | **TOT** |
| **Professional Elective – II** | | | | | | | | | |
| 19ADPX05 | Cyber Security | PE | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 19CSPX11 | Green Computing | PE | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 19CSPX12 | Agile Methodology | PE | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 19CSPX13 | Game Programming | PE | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 19CSPX06 | Total Quality management | PE | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 19CSPX24 | Information Retrieval Techniques | PE | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| **Course Code** | **Name of the Subject** | Category | **Hours / Week** | | | **Credit** | **Maximum Marks** | | |
| | | | **L** | **T** | **P** | **C** | **CIA** | **ESE** | **TOT** |
| **Professional Elective – III** | | | | | | | | | |
| 19ADPX06 | Ethics of Artificial Intelligence | PE | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 19CSPX07 | C# and .Net Programming | PE | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 19CSPX22 | Software Quality Assurance | PE | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 19CSPX01 | Data Warehousing and Mining | PE | 3 | 0 | 0 | 3 | 40 | 60 | 100 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 19CSPX19 | Service Oriented Architecture | PE | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 19CSPX14 | Software Project Management | PE | 3 | 0 | 0 | 3 | 40 | 60 | 100 |

**LIST OF OPEN ELECTIVE (OE) COURSES FOR OTHER BRANCHES**

| Course Code | Name of the Subject | Category | Hours / Week | | | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | C | CIA | ESE | TOT |
| **OPEN ELECTIVE – I** | | | | | | | | | |
| 19ADOX01 | Operating Systems Fundamentals | OE | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 19ADOX02 | Cognitive Science and Analytics | OE | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 19CSOX07 | Customer Relationship Management | OE | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 19CSOX04 | Unix Internals | OE | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 19CSOX05 | Bio Informatics | OE | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| **Course Code** | **Name of the Subject** | **Category** | **Hours / Week** | | | **Credit** | **Maximum Marks** | | |
| | | | **L** | **T** | **P** | **C** | **CIA** | **ESE** | **TOT** |
| **OPEN ELECTIVE – II** | | | | | | | | | |
| 19CSOX06 | Web Designing | OE | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 19ADOX03 | Parallel and Distributed Computing | OE | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 19CSOX08 | E-Commerce and Applications | OE | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 19CSOX09 | Social Network Analysis | OE | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 19CSOX10 | Multimedia Systems | OE | 3 | 0 | 0 | 3 | 40 | 60 | 100 |

## LIST OF GENERAL ELECTIVE (GE) COURSES

| Course Code | Name of the Subject | Category | Hours / Week | | | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | C | CIA | ESE | TOT |
| 19NCCL01 | NCC AIRFORCE LEVEL-1 | GE | 2 | 0 | 2 | 3 | 40 | 60 | 100 |
| 19NCCL02 | NCC AIRFORCE LEVEL - 2 | GE | 2 | 0 | 2 | 3 | 40 | 60 | 100 |

## SEMESTER I

**19HST101** **COMMUNICATIVE TECHNO ENGLISH - I** **L T P C**

(Common to all branch) **3 0 0 3**

**OBJECTIVES**

To enable students to:

- Understand the basics of the English Language in a graded manner.
- Enrich grammar usage for the development of all the four language skills (LSRW).
- Improve writing skills to express thoughts freely through Informal Letter, e-mail writing
- Develop speaking skills through self introduction and delivering speeches.
- Enhance the Reading Skills

**UNIT I VOCABULARY** **8**

Synonyms and Antonyms- Single Word Substitutes - Use of Abbreviations and Acronyms- Homonyms and Homophones- Business Vocabulary - Commonly Confused Words- Collocation - British and American Vocabulary- Word formation.

**Activity: Grammar worksheets on the given topics.**

**UNIT II GRAMMAR** **10**

Parts of speech - Be, Have and Do verbs - Punctuation - Tenses - Numerical Adjectives - modal verbs - Single line Definition- Direct and Indirect Speech- Gerunds and Infinitives - Same Word Used as Different Parts of Speech.

**Activity: Grammar worksheets on the given topics**.

**UNIT III INFORMAL WRITING** **9**

Letter Writing - Informal Letters – e-mail Writing - Informal Dialogues – Essay Writing- Informal Essays- Movie Reviews -Writing Instructions.

**Activity: Giving topic and ask the students to write informal letters, e-mail.**

**UNIT IV LANGUAGE ENHANCEMENT THROUGH SPEAKING** **9**

Self Introduction– (exchanging personal information) personal information, hobbies, strengths and weaknesses, likes and dislikes, special features of home town. Narrating Personal Experiences and Incidents- Two minute talk- expressing attitudes and opinions in Debate discussion.

**Activity: Ask the students to speak about the above given topics.**

**UNIT V READING SKILLS 9**

Reading Comprehension – reading techniques, pre-reading, post-reading, comprehension questions (multiple choice questions or short questions)- Short comprehension passages, practice skimming-scanning and predicting - Reading the passage and taking (Note making) Notes - Scan and understand main contents of the passage.

**Activity: Giving topic and ask the students to find out answers for given passage**

**TOTAL: 45 PERIODS**

**OUTCOMES**

Upon completion of the course, the students will be able to:

- Use a wide range of vocabulary in oral and written communication
- Frame grammatically correct sentences.
- Write informal letters and other communications.
- Give short informal presentations and participate in classroom discussions
- Learn to acquire usage of English.

**TEXT BOOKS**

1. Board of Editors. Using English A Course book for Under graduate Engineers and Technologists. Orient Black Swan Limited, Hyderabad: 2015.
2. Richards, C. Jack. Interchange Students' Book-2 New Delhi: CUP, 2015.

**REFERENCES**

1. Department of English, Anna University, "Mindscapes: English for Technologists and Engineers", 1st Edition, Orient Black Swan, Chennai. 2012.
2. Krishna Mohan, Meera Banerji ,"Developing Communication Skills", MacMillan Publishers, Paperback 2019.

**E-RESOURCES**

1. http://www.usingenglish.com
2. https://www.khanacademy.org/humanities/grammar

**19MAT101** **ENGINEERING MATHEMATICS - I** **L T P C**

**(Common to all branch)** **3 1 0 4**

**OBJECTIVES**

The main objective of this course is to:

- Develop the use of matrix algebra techniques that are needed by engineers for practical applications.
- Familiarize the students with differential calculus.
- Describe the student with functions of several variables.
- Explore the students understand various techniques of integration.
- Acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications.

**UNIT I: MATRICES** **9+3**

Eigen values and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigen values and Eigenvectors – Cayley-Hamilton theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

**UNIT II: DIFFERENTIAL CALCULUS** **9+3**

Representation of function – Limit of a function – Continuity – Derivatives – Differentiation rule – Maximum and Minimum values – absolute Maximum and Minimum – local Maximum and Minimum.

**UNIT III: FUNCTIONS OF SEVERAL VARIABLES** **9+3**

Partial differentiation -Homogeneous functions and Euler's theorem - Total derivative - Jacobians - Taylor's series for functions of two variables - Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

**UNIT IV: INTEGRAL CALCULUS** **9+3**

Definite and Indefinite integral – Substitution rule – Integration by parts - Trigoniometric substitutions – Integration of rational function by partial fraction – Improper integrals – Bernoulli's formula.

**UNIT V: MULTIPLE INTEGRALS** **9+3**

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and

triple integrals.

**TOTAL: 45+15=60 PERIODS**

**OUTCOMES**

Upon completion of this course, the students will be able to :

- Classify the matrix algebra methods for solving practical problems.
- Discover differential calculus tools in solving various application problems.
- Develop differential calculus ideas on several variable functions.
- Compare different methods of integration in solving practical problems.
- Apply multiple integral ideas in solving areas, volumes and other practical problems.

**TEXT BOOKS**

1. Grewal B.S., - "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7th Edition, New Delhi, 2015.

**REFERENCES**

1. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
2. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics Ⅱ", Narosa Publications, New Delhi, 3rd Edition, 2007.
3. Narayanan, S. and Manicavachagom Pillai, T. K., "Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2007.
4. Srimantha Pal and Bhunia, S.C, "Engineering Mathematics" Oxford University Press, 2015.
5. Weir, M.D and Joel Hass, "Thomas Calculus", 12th Edition, Pearson India, 2016.

**E-RESOURCES**

1. https://nptel.ac.in/courses/111105121
2. https://nptel.ac.in/courses/111107112

**19CYE101** **ENGINEERING CHEMISTRY** **L T P C**

(Lab Embedded Theory Course) **3 0 2 4**

(Common to all branch)

**OBJECTIVES**

To enable students to:

- Classify the impurities of water and know the treatment and the conditioning methods for domestic and industrial uses.
- Outline about fundamentals, properties and moulding process of polymers.
- Discuss the types of corrosion and control measures and working of batteries.
- Explain about the phase rule and its applications to engineering field and also gain knowledge about the properties of alloys.
- Summarize the basics of Nanochemistry, synthesis, properties and applications of Nano materials.
- Acquire practical skills in the determination of water quality parameters, molecular weight of polymer, rate corrosion through volumetric and instrumental analysis.

**UNIT I WATER TECHNOLOGY** **9**

Introduction - Characteristics – hardness – estimation of hardness by EDTA method – alkalinity and its estimation - Boiler feed water – requirements –Boilers troubles (Scale and Sludge) – Internal conditioning (colloidal – phosphate – calgon and carbonate conditioning methods) – External conditioning – zeolite process, demineralization process – Desalination of brackish water by reverse osmosis - Municipality water treatment - Break point chlorination.

**UNIT II POLYMER CHEMISTRY** **9**

Introduction - Classification of polymers – Natural and synthetic; Thermoplastic and Thermosetting. Functionality – Degree of polymerization. Types of polymerization: Addition condensation and copolymerization, Properties of polymers: Tg, Tacticity, Molecular weight – weight average, number average and polydispersity index. Preparation, properties and uses of PVC, Nylon 6,6, Polyethylene - Rubbers – types – vulcanization of rubber – Plastics – Moulding constituents of plastics – Moulding of plastics - compression, injection and blow moulding-Biodegradable polymers-Conducting polymers.

**UNIT III CORROSION AND BATTERY TECHNOLOGY** **9**

Corrosion – Types – Chemical Corrosion – Electrochemical Corrosion (galvanic and Differential aeration) - Factors influencing corrosion – Material selection and design aspects-control methods of

corrosion –Sacrificial anodic and impressed current cathodic protection - Protective coatings – paints – constituents and their functions - electroplating of Copper - electroless plating of Nickel. Batteries: Definition, Types - example Lead acid battery, Lithium ion battery – H2 – O2 fuel cell-solar cell.

**UNIT IV PHASE RULE AND ALLOYS 9**

Phase rule - explanation of terms involved – one component system – water system – condensed phase rule – construction of phase diagram by thermal analysis – simple eutectic systems (lead – silver system only).

Alloys: Introduction- definition- properties of alloys- significance of alloying, functions and effect of alloying elements - ferrous alloys – nichrome and stainless steel – heat treatment of steel, non-ferrous alloys – brass and bronze.

**UNIT V CHEMISTRY OF NANO MATERIALS 9**

Nano chemistry – Basics ( Surface area to volume ratio - Quantum confinement – (0D, 1D, 2D & 3D) - Distinction between Molecules, Nanoparticles and Bulk Materials - Characterisation of nano materials using XRD and SEM. Synthesis of nano materials: Top down approach - Ball milling - Bottom up approach - Sol-gel method, Chemical vapour deposition - Properties of nanomaterials and Applications of Nanomaterials (Nano products of today).

**LABORATORY PART**

**LIST OF EXPERIMENTS**

(Any Eight Experiments to be conducted)

1. Determination of total, temporary & permanent hardness of water by EDTA method.
2. Determination of alkalinity in water sample.
3. Determination of DO content of water sample by Winkler's method.
4. Determination of chloride content of water sample by Argentometric method.
5. Determination of strength of given hydrochloric acid using pH meter.
6. Estimation of sodium and potassium present in water using flame photometer.
7. Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.
8. Conductometric titration of strong acid vs strong base.
9. Corrosion experiment-weight loss method.
10. Estimation of copper content in the brass by Iodometry.
11. Determination of pH of soil.

**TOTAL: 45+15=60 PERIODS**

**OUTCOMES**

Upon completion of the course, the students will be able to:

- Develop innovative methods to produce soft water for industrial and domestic use at cheaper cost.
- Understand the chemical structure of polymers and its effect on their various properties when used as engineering materials and also discuss the applications of polymers.
- Illustrate the principles involved in corrosion reactions and techniques used for preventing it and acquire the ability to design and develop materials for energy storage systems.
- Acquire knowledge of phase, equilibrium, component, degree of freedom and phase rule concepts, basic's of alloys and its applications.
- Explain the basics of nanochemistry, synthesis, characterization, properties of nanomaterials and its applications.
- Apply the practical knowledge for determining the water quality parameters and demonstrate the instrumental analysis.

**TEXT BOOKS**

1. Jain P.C and Monika Jain, "Engineering Chemistry", Dhanpet Rai Publishing Company (P) Ltd.,New Delhi, 2013.
2. Viswanathan B, "Nanomaterials" Alpha Science International Ltd, 2009

**REFERENCES**

1. S. S. Dara and S. S. Umare, "A Textbook of Engineering Chemistry", S. Chand & Company LTD, New Delhi, 2015.
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2012.

**E-RESOURCES**

1. https://nptel.ac.in/courses/118104008
2. https://nptel.ac.in/courses/118102003

| 19PHE101 | ENGINEERING PHYSICS<br>(Lab Embedded Theory Course)<br>(Common to all branch) | L T P C<br>3 0 2 4 |
|---|---|---|

**OBJECTIVES**

The main objective of this course is to:

- Recognize the structure of crystalline materials using crystallographic knowledge.
- Apply the knowledge of material's elasticity, stress, strain for industrial applications.
- Generalize the fundamentals of lasers and optical fibres, as well as their applications.
- Investigate the complex physical phenomenon using the fundamental principles of quantum mechanics and Schrödinger's wave equation.
- Design the structures with acoustics, ultrasonic production for structural applications.
- Judge the Engineering Physics that can be applied to optics, thermal physics, matter characteristics and to determine fluid properties.

**UNIT I STRUCTURE OF SOLIDS 9**

Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d -Spacing in Cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – Crystal Growth Techniques –Solution, melt (Bridgman and Czochralski) and Vapour growth techniques(qualitative).

**UNIT II ELASTICITY 9**

Elasticity – Stress-Strain diagram and its uses - Factors affecting elastic modulus and tensile strength – Torsional stress and deformations – Twisting couple - Torsion pendulum: theory and experiment - Bending of beams :Bending moment – Cantilever: Theory and Experiment – Uniform and Non-uniform bending: Theory and experiment - I- Shaped girders.

**UNIT III PHOTONICS 9**

Introduction to interaction of radiation with matter- Spontaneous and Stimulated emission- Population Inversion - Derivation of Einstein's A and B coefficients – Principle and working of Laser - Nd:YAG laser - Direct bandgap and indirect band gap semiconductors - Semiconductor diode Laser- Principle and propagation light in optical fibres- Derivation of Numerical aperture and Acceptance angle - Fibre optic communication system.

**UNIT IV QUANTUM PHYSICS** **9**

Black body radiation – Planck's theory (derivation) – Compton Effect: theory and experimental verification – Wave particle duality – Electron diffraction – Concept of wave function and its Physical significance – Schrödinger's wave equation: Time independent and time dependent equations – Particle in a one-dimensional rigid box- Quantum Tunnelling –Tunnelling Electron Microscope.

**UNIT V ACOUSTICS AND ULTRASONICS** **9**

Classification of sound- decibel- Weber–Fechner law – Sabine's formula - Derivation using growth and decay method – Absorption Coefficient and its determination – Factors affecting acoustics of buildings and their remedies Introduction- Classification of Sound waves - Production of Ultrasonic's by magnetostriction and piezoelectric methods - Acoustic grating – Cavitations - Applications of Ultrasonic's

**LABORATORY PART**

**LIST OF EXPERIMENTS**

**(Eight experiments are to be conducted in Lab and Two experiments are to be conducted virtually)**

1. Laser: Determination of wavelength of laser and particle Size.
2. Fibre Optics: Determination of Numerical Aperture and Acceptance angle.
3. Determination of wavelength of mercury spectrum- Spectrometer.
4. Determination of Young's modulus – Non- Uniform bending.
5. Determination of Young's modulus - Uniform bending.
6. Torsional Pendulum: Determination of moment of inertia and rigidity modulus.
7. Determination of velocity of ultrasonic in liquid.
8. Determination of Viscosity of a liquid –Poiseulle's Method
9. Photoelectric Effect.(Virtual)
10. Determination of band gap of semiconductor.(Virtual)

**TOTAL: 45 + 15 = 60 PERIODS**

**OUTCOMES**

At the end of the course, the students will be able to

- Familiarize the structure of crystalline solids by applying knowledge of crystallography.
- Analyze theories of failure and yield criteria as an elements of properties of matter.
- Learn the basics of lasers and optical fibers and their use in some applications
- Apply the basic principles of quantum mechanics and Schrödinger's wave equation to study the

complex physical phenomenon

- Comprise the fundamentals of Acoustics, production and applications of ultrasonic's.
- Compose principles of elasticity, optics and acoustic properties in engineering applications through experiments.

**TEXT BOOKS**

1. Avadhanulu M.N & Kshirsagar P.G "Text Book of Engineering Physics". S.Chand, 2006
2. P.Mani, "Engineering Physics Practicals", Dhanam Publications, 2019

**REFERENCES**

1. Raghavan V, Materials Science and Engineering: A First Course, PHI Publications, 2015
2. Rajendran V."Engineering Physics". Tata McGraw Hill Publications, 2012

**E-RESOURCES**

1. https://www.classcentral.com/course/youtube-basic-courses-engineering-physics
2. https://www.courses.com/physics

| 19GET101 | ENGINEERING GRAPHICS<br>(Common to all branch) | L T P C<br>3 0 0 3 |
|---|---|---|

**OBJECTIVES**

The main objective of this course is to:

- Understand the principles in graphic skill to communicate the concepts, ideas and design of engineering components.
- Learn projections of points, lines, planes viewed in different positions.
- Learn the projection of solids viewed in different positions.
- Gain the knowledge about the section of solids and development of surfaces of the given solids.
- Expose the international standards of technical drawing.

**UNIT I GENERAL PRINCIPLES OF ORTHOGRAPHIC PROJECTION 9**

Graphics significance in engineering applications - study of drafting instruments - BIS conventions and specifications - Size, layout and folding of drawing sheets – principle of Letter writing and dimensioning. Projections of points, lines and planes. Principles of orthographic projection - First angle projection only - Layout of views - Projection of points located in all quadrant - Projection of polygonal surface and circular lamina inclined to both reference planes.

**UNIT II PROJECTION OF SOLIDS 9**

Projections of solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method.

**UNIT III SECTION OF SIMPLE SOLIDS 9**

Section of solids - prisms, pyramids, cylinder and cone. Obtaining sectional views and true shape when the axis of the solid is vertical and cutting plane inclined to one reference plane.

**UNIT IV DEVELOPMENT OF SURFACES 9**

Development of lateral surfaces of simple and truncated solids - prisms, pyramids, cylinders and cones with cutout, perpendicular and inclined to the horizontal axis

**UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 9**

Principles of isometric projection – isometric scale – isometric projections of simple solids, truncated prisms, pyramids, cylinders and cones. Conversion of isometric projection into orthographic projection. Perspective projection of prisms, pyramids and cylinders by visual ray method.

**TOTAL: 45 PERIODS**

## OUTCOMES

At the end of the course, the students will be able to:

- Construct multiple views of engineering components.
- Prepare the pictorial drawings as per the standards.
- Develop the projection of solids.
- Draw the section of solids drawings and development of surfaces of given objects.
- Apply free hand sketching and concept of isometric in engineering practice.

## TEXT BOOKS

1. Venugopal K. and Prabhu Raja V., - "Engineering Graphics", 15th Edition, New Age International (P) Limited, New Delhi, 2018.
2. Natarajan K.V., "Engineering Graphics", 32nd Edition, Dhanalakshmi Publishers, Chennai, 2019.

## REFERENCES

1. K.R. Gopalakrishna, "Engineering Drawing Volume 1 & 2", 55th Edition, Subhas Publications, Bangalore, 2017.
2. T.Jeyapoovan., "Engineering Graphics using Auto CAD" 3rd Edition, vikas publishing house Pvt Ltd, New Delhi, 2017.

## E- RESOURCES

1. https://nptel.ac.in/courses/112/103/112103019/ - (Geometric Constructions)
2. https://nptel.ac.in/courses/105/104/105104148/ - (Projections)

**19GEE101 COMPUTER FUNDAMENTALS AND PYTHON PROGRAMMING L T P C**
(Lab Embedded Theory Course) **3 0 2 4**
(Common to all branch )

**OBJECTIVES**

The course objectives are to:

- Enable the student to learn the major components of a computer system and software.
- Know the basics of algorithmic problem solving and fundamentals of python programming.
- Develop simple python programs.
- Define controls and functions in python.
- Use python data structures - lists, tuples and dictionaries.
- Practice the students to work with Word,excel and Python applications.

**UNIT I INTRODUCTION 9**

Introduction, Characteristics of Computers, Generation and Classifications of Computers, Basic Computer Organization, Computer Software, Types of Software, Software Development Steps, Internet, Getting connected to Internet Applications

**UNIT II PROBLEM SOLVING AND PYTHON FUNDAMENTALS 9**

Algorithms, building blocks of algorithms (instructions/statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Introduction to Python: Basics of Python and history of Python - Unique features of Python, interpreter and interactive mode - values and types: int, float, boolean, string, and list; variables.

**UNIT III EXPRESSIONS AND STATEMENTS 9**

Expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

**UNIT IV CONTROL FLOW AND FUNCTIONS 9**

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions, Strings, Lists as arrays. Illustrative programs: square root, gcd, Tower of Hanoi, exponentiation, sum an array of numbers, linear

search, binary search.

**UNIT V LISTS, TUPLES AND DICTIONARIES 9**

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension.

**LABORATORY PART**

**LIST OF EXPERIMENTS**

(Any Eight to be conducted)

1. Document Creation, Table Creation and Flow chart
2. Spread sheet- Chart, Formula, Sorting
3. Compute the GCD of two numbers.
4. Find the square root of a number (Newton's method)
5. Exponentiation (power of a number)
6. Find the maximum of a list of numbers
7. Linear search and Binary search
8. First n prime numbers
9. Multiplication of two matrices
10. Simulate elliptical orbits in Pygame

**TOTAL: 45+15 = 60 PERIODS**

**OUTCOMES**

Upon completion of the course, the students will be able to:

- Know the Computer basics, Components and Sofwares.
- Develop algorithmic solutions to simple computational problems and Read, write, execute by hand simple Python programs.
- Structure simple Python programs for solving problems.
- Decompose a Python program into functions.
- Represent compound data using Python lists, tuples, and dictionaries.
- Apply the practical knowledge on Word,Excel and Python Applications.

**TEXT BOOKS**

1. Ashok.N.Kamthane," Computer Programming", Pearson Education (India), (2015).
2. Allen B. Downey, ''Think Python: How to Think Like a Computer Scientist'', 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016.

## REFERENCES

1. Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python ''– Revised and updated for Python 3.2, Network Theory Ltd., 2011.
2. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.

## E-RESOURCES

1. https://nptel.ac.in/courses/106/106/106106145/ - (Introduction to Algorithms)
2. https://nptel.ac.in/courses/106/106/106106182/ - (Joy of Computing)

| 19EEC101 | LIFE SKILLS FOR ENGINEERS<br>(Employability Enhancement Course)<br>(Common to all branch) | L T P C<br>2 0 0 0 |
|---|---|---|

**OBJECTIVES**

To enable students to:

- Develop communication competence for engineers.
- Enable them to convey thoughts and ideas with clarity and focus
- Inculcate critical thinking process
- Prepare them on problem solving skills
- Provide symbolic, verbal, and graphical interpretations of statements in a problem description

**UNIT I COMMUNICATION SKILL 6**

Introduction to Communication, The Process of Communication, Barriers to Communication, Listening Skills, Non-verbal Communication and Body Language, Interview Skills, Group Discussion, Presentation Skills, Technology-based Communication-Technical presentations.

**UNIT II CRITICAL THINKING & PROBLEM SOLVING 6**

Creativity, Lateral thinking, Critical thinking, Multiple Intelligence, Problem Solving, Mind Mapping & Analytical Thinking.

**UNIT III CAREER SKILLS 6**

Introduction to Employability and Career Skills - developing a long - term career plan - making career changes -Time Management - General awareness of Current Affairs - Stress management - Leadership straits - Team work - Career planning.

**UNIT IV ETHICS MORAL & PROFESSIONAL VALUES 6**

Human Values, Civic Rights, Engineering Ethics, Engineering as Social Experimentation, Environmental Ethics, Global Issues.

**UNIT V LEADERSHIP SKILLS 6**

Leadership, Levels of Leadership, Making of a leader, Types of leadership, Transactions Vs Transformational Leadership, VUCA Leaders, DART Leadership, Leadership Grid & leadership Formulation.

**TOTAL: 30 PERIODS**

**OUTCOMES**

Upon completion of the course, the students will be able to:

- Communicate effectively
- Make effective presentations
- Develop critical thinking.
- Face interview & group discussion.
- Critically think on a particular problem

**TEXT BOOKS**

1. Life Skills for Engineers, McGraw Hill Education (India) Private Ltd., 2016.
2. E. Suresh Kumar et al. Communication for Professional Success. Orient Blackswan: Hyderabad, 2015.

**REFERENCES**

1. Barun K. Mitra; (2011), "Personality Development & Soft Skills", 1st Edition; Oxford Publishers.
2. Kalyana; (2015) "Soft Skill for Managers"; First Edition; Wiley Publishing Ltd.

## SEMESTER II

| 19HST201 | COMMUNICATIVE TECHNO ENGLISH - II | L T P C |
|---|---|---|
| | (Common to all branch) | 3 0 0 3 |

**OBJECTIVES**

To enable students to:

- Acquire usage of grammar in English language.
- Enhance the reading skill to comprehend technical writing.
- Improve business writing skills.
- Develop presentation skills in analytical view.
- Help learners to develop their speaking skills and speak fluently in real contexts.

**UNIT I GRAMMAR** **9**

Compound words- prepositions- articles- conditionals - Direct and indirect speeches-subject verb agreement- Active and passive voice- Impersonal Passive Voice.

**Activity:** Grammar worksheets on the given topics.

**UNIT II LANGUAGE ENHANCEMENT THROUGH LISTENING & READING** **9**

Syllabification- sentence stress –Reading Vocabulary-Reading News Papers-. Listening to You Tube Documentaries- Listening to Podcast-Listening to motivational Movies

**Activity:** Playing movies & podcast and enhancing listening vocabulary.

**UNIT III BUSINESS WRITING** **9**

Writing Recommendations - Checklist- Business Letters - Calling for Quotations, Placing Orders, Letter of Complaint, Letter of Clarification - Cover Letter with Résumé- Report Writing - Accident Report, Industrial Visit Report, Survey Report and Feasibility Report.

**Activity:** Giving topic and ask the students to prepare checklist and complaint.

**UNIT IV WRITING** **9**

Transcoding Graphics - Bar Chart, Flow Chart, Pie Chart and Tables-Tour Itinerary - Process Description- Agenda and Minutes of meeting.

**Activity:** Giving charts to the students and ask them to transcode.

**UNIT V SPEAKING** **9**

Collaborative task - Turn taking (initiating and responding appropriately) - Negotiating - Exchanging -

suggesting - comparing and contrasting – expressing - Finding out facts, attitudes and opinions - Commonly mispronounced words- Roleplay.

**TOTAL: 45 PERIODS**

**OUTCOMES**

Upon completion of the course, the students will be able to:

- Acquire advanced level grammatical knowledge.
- Improve their language usage in LSRW skills.
- Enhance the writing skills to express the ideas in the business context
- Acquire the ability to understand different written texts.
- Categorize a wide range of vocabulary and English usage.

**TEXT BOOKS**

1. S. Sumant Maven Learning, "Technical English II**"** January 2011
2. KN Shoba, Lourdes Joavani Rayen "Communicative English" Cambridge university 2017

**REFERENCES**

1. Dr K Elango, Dr. Veena Selvam, Dr. Sujatha Priyadarshini, "Resonance English for Engineers and Technologists".Cambridge University Press, 1st Edition, Foundation Books,New Delhi, 2013.
2. Seely, John. Oxford Guide to Effective Writing and Speaking. Indian ed. New Delhi: Oxford University Press. 2005.

**E-RESOURCES**

1. https://www.fluentu.com/Blog/english/english-small-talk/
2. https://www.britishcouncil.com

| 19CYT201 | ENVIRONMENTAL SCIENCE AND ENGINEERING (Common to all branch) | L T P C 3 0 0 3 |
|---|---|---|

**OBJECTIVES**

The main objective of this course is to:

- Explain the importance of the environment, concepts of ecosystem and overview of biodiversity and its conservation.
- Summarize the causes, effects and control of the various environmental pollution.
- Describe about natural resources and resource management.
- Assess the social issues to improve the quality of environment.
- Analyse the causes of population explosion, importance of value education and relation between human health and environment.

**UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 11**

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, rivers, oceans) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

**Activity: Biodiversity in and around the campus and report submission.**

**UNIT II ENVIRONMENTAL POLLUTION 9**

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – solid waste management: causes, effects and control measures of municipal solid wastes - e-waste – role of an individual in prevention of pollution - pollution case studies – disaster management: floods, earthquake and cyclone.

**Activity: Local Pollution Case Study and report submission.**

**UNIT III NATURAL RESOURCES 10**

Forest resources: Use and over-exploitation, deforestation, dams and their effects on forests and tribal people – Water resources: Use and over- utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation,

environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources.

**Activity: Waste to wealth**.

**UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 9**

From unsustainable to sustainable development – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies - environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – Green Chemistry and principles - environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – Public awareness.

**Activity: Creating Environmental Awareness**.

**UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6**

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

**Activity: Visit to local primary health center.**

**TOTAL: 45 PERIODS**

**OUTCOMES**

Upon completion of the course, the students will be able to:

- Discuss about the features of various ecosystems and need of conservation of biodiversity.
- Apply the appropriate methodologies to control the various environmental pollution.
- Get the knowledge about the different types of resources like land, water, mineral and energy and also about the effects of environment by the usage of these resources.
- Assess the social issues to improve the quality of environment and participating actively in solving current environmental problem.
- Find solution for the effects of the population explosion as well as environmental and human health issues.

**TEXT BOOKS**

1. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006.
2. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.

**REFERENCES**

1. Erach Bharucha, 'Textbook of Environmental Studies', Universities Press (I) Pvt Ltd., Hydrabad, 2015.
2. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India Pvt Ltd., New Delhi, 2007

**E-RESOURCES**

1. https://nptel.ac.in/courses/103107084
2. https://nptel.ac.in/courses/120108005

**19MAT201** **ENGINEERING MATHEMATICS – II** **L T P C**
(Common to all branch) **3 1 0 4**

**OBJECTIVES**

The main objective of this course is to:

- Acquire sound knowledge of techniques in solving ordinary differential equations obtained from engineering problems.
- Acquaint the student with the concepts of vector calculus that is needed for problems in engineering disciplines.
- Develop the fundamental concepts in analytic functions, conformal mapping and Bilinear transformations.
- Extend the standard techniques of complex integration.
- Compose the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

**UNIT I DIFFERENTIAL EQUATIONS 9+3**

Higher order linear differential equations with constant coefficients - Method of variation of parameters – Homogenous equation of Euler's and Legendre's type - System of simultaneous linear differential equations with constant coefficients.

**UNIT II VECTOR CALCULUS 9+3**

Gradient and directional derivative - Divergence and curl – Line integral over a plane curve – Surface integral – Area of a curved surface – volume integral – Green's, Gauss divergence and Stoke's theorems – Verification and application in evaluating line, surface and volume integrals.

**UNIT III ANALYTIC FUNCTIONS 9+3**

Analytic functions – Necessary and sufficient conditions for analyticity in Cartesian and polar coordinates – Properties – Harmonic conjugates – Construction of analytic function – Conformal mapping – Mapping by function $W = \frac{1}{z}$ – Bilinear transformation.

**UNIT IV COMPLEX INTEGRATION 9+3**

Cauchy's integral theorem– Cauchy's integral formula –Laurent's series – Application of residue theorem for evaluation of real integrals – Use of circular contour and semicircular contour.

**UNITV LAPLACE TRANSFORMS 9+3**

Existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function – Basic properties – Shifting theorems -Transforms of derivatives and integrals – Inverse transforms – Convolution theorem – Transform of periodic functions – Application to solution of linear second order ordinary differential equations with constant coefficients.

**TOTAL: 45+15 = 60 PERIODS**

**OUTCOMES**

Upon completion of this course, the students will be able to :

- Apply various techniques in solving differential equations which arises in Engineering problems.
- Solve engineering problems using the concept of vector calculus.
- Develop the concept of analytic functions, conformal mapping and Bilinear transformations.
- Evaluate integrals using Cauchy's integral formula and residue theorem.
- Build the Laplace transforms techniques in solving differential equations.

**TEXT BOOKS**

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7th Edition, New Delhi, 2015.

**REFERENCES**

1. Kreyszig Erwin, "Advanced Engineering Mathematics ", John Wiley and Sons, Delhi, 10th Edition, New 2016.
2. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 3rd Edition, 2007

**E-RESOURCES**

1. https://nptel.ac.in/courses/111105134
2. https://nptel.ac.in/courses/111106139

**19PHT202 SOLID STATE PHYSICS AND NANOELECTRONIC DEVICES L T P C**

(Common to II Semester IT and MEE branches) **3 0 0 3**

**OBJECTIVES**

The main objectives of this course are to:

- Interrelate the basic conduction process in conducting materials.
- Differentiate the working concept semiconducting devices from other devices.
- Develop the knowledge in Superconducting and Dielectric materials.
- Make use of the light phenomenon in optical materials fabrication.
- Implement the knowledge of Nano Electronic Devices for future applications.

**UNIT I CONDUCTING MATERIALS 9**

Conductors – Classical free electron theory of metals – Electrical and thermal conductivity – Wiedemann — Franz law , Lorentz number — Draw backs of classical theory — Ohm‟s law verification - Fermi Dirac distribution function – Effect of temperature on Fermi Function – Density of energy states – Carrier concentration in metal - Average energy of an electron. Effective mass of electron and Concept of hole

**UNIT II SEMICONDUCTING MATERIALS 9**

Elemental and compound semiconductors – Intrinsic semiconductor – Carrier concentration derivation – Fermi level – Derivation of carrier concentration in n-type and p-type semiconductor (Qualitative) – Hall effect and applications. - Working of PN junction diode – Schottky diode- Ohmic contacts- Tunnel diode.

**UNIT III SUPERCONDUCTING AND DIELECTRIC MATERIALS 9**

Superconductivity: Properties — Type I and Type II superconductors — BCS theory of superconductivity - High Tc superconductors – General applications of superconductors – Cryotron and Magnetic levitation. **Dielectric Materials**: Electrical susceptibility – Dielectric constant – Electronic, ionic, orientation and space charge polarization- Internal filed and Clausius-Mosotti Relation - Ferro electricity and applications

**UNIT IV OPTICAL MATERIALS 9**

Introduction-optical materials – Carrier generation and recombination processes –Solar cell – Photo detectors-PIN diode – Light Emitting Diode (LED) – Organic Light Emitting Diode (OLED) Laser diode - Liquid Crystal Display (LCD) - Excitons- - Optical data storage techniques- Plasmonics.

**UNIT V NANO ELECTRONIC DEVICES** **9**

Introduction- Quantum confinement- Quantum well, quantum wire and quantum dot structure – Tunneling: single electron phenomena and single electron transistor (SET) — Quantum dot laser- quantum bits (qubits)- quantum computing- Carbon Nano Tubes (CNT) structure, properties and applications. Concepts of Molecular Transistor- Graphene Transistor – Carbon nano tube transistor - Applications of Nanodevices and Nanosensors.

**TOTAL: 45 PERIODS**

**OUTCOMES**

Upon completion of this course, the students will be able to:

- Explain the nature of conducting materials and to calculate the parameters involved.
- Enhance basic concept of semiconductor, Hall effect, the principles of LED andphotodiodes.
- Create, apply and disseminate knowledge leading to innovation Superconducting and Dielectric Materials.
- Acquire knowledge about optical Materials for advancement of applications.
- Grasp the basis of nanomaterials and their innovative uses to the human kind.

**TEXT BOOKS**

1. Kasap, S.O. "Principles of Electronic Materials and Devices", McGraw-Hill Education, 2007.
2. Rajendran V. "Engineering Physics". Tata McGraw Hill Publications, 2012.

**REFERENCES**

1. Garcia, N. & Damask, A. "Physics for Computer Science Students". Springer-Verlag,2012.
2. Hanson, G.W. "Fundamentals of Nanoelectronics". Pearson Education, 2009.

**E - RESOURCES**

1. https://nptel.ac.in/downloads/122101002
2. https://swayam.gov.in/nd1_noc19_ph14/preview

**19GET201 FUNDAMENTALS OF ELECTRICAL ELECTRONICS AND INSTRUMENTATION L T P C**

(Lab Embedded Theory Course) **3 0 0 3**

(Common to IT)

**OBJECTIVES**

The main objective of this course is to:

- Introduce the basics of electric circuits and analysis
- Impart knowledge in the basics of working principles and application of DC machines and Transformers
- Acquire knowledge in the basics of working principles and application of Induction machines
- Familiarize the operation of diodes, transistors and thyristors
- Educate the functional elements and principle of measuring instruments and transducers

**UNIT I ELECTRICAL CIRCUITS 9**

DC Circuits: Circuit Components: Conductor, Resistor, Inductor, Capacitor - Ohm's Law - Kirchhoff's Laws - Independent and Dependent Sources - Simple problems - Mesh analysis, Nodal Analysis with Independent sources only (Steady stateIntroduction to AC Circuits and Parameters: Waveforms, Average value, RMS Value, Instantaneous power, real power, reactive power and apparent power, power factor - Steady state analysis of RLC circuits (Simple problems only).

**UNIT II DC MACHINES AND TRANSFORMERS 9**

DC Generators: Construction, Working principle, EMF equation, Types, Characteristics and Applications. DC motors: Working Principle, Torque Equation, Types, Characteristics, Speed Control and Applications. Transformers: Construction, Working principle, EMF equation and Applications of Transformer.

**UNIT III INDUCTION MACHINES 9**

Single phase and Three phase induction motors: Construction, Principle of operation, Types - Alternators: Construction, Principle of operation, Types - Synchronous motors - Introduction to special Electrical machines.

**UNIT IV ANALOG ELECTRONICS 9**

Resistor ,Inductor and Capacitor in Electronic Circuits - Semiconductor Materials: Silicon & Germanium - PN Junction Diodes and Zener Diode: Characteristics and Applications - BJT, JFET, SCR, MOSFET, IGBT: Construction, Working, V-I Characteristics and Applications - Rectifiers

**UNIT V MEASUREMENTS AND INSTRUMENTATION 9**

Functional elements of an instrument - Standards and calibration - Moving Coil and Moving Iron meters: Operating Principle, types - Measurement of three phase power, Energy Meter - Instrument Transformers: CT and PT - Classification of Transducers - Resistive, Inductive and Capacitive Transducers..

**TOTAL : 45 PERIODS**

**OUTCOMES**

At the end of the course, the students will be able to:

- Compute the electric circuit parameters for simple problems
- Interpret the characteristics of electrical generators, motors and transformers
- Gain knowledge about the basic principles and working of Single phase induction motors and Special Electrical Machines.
- Analyze the structure and characteristics of diodes, transistors and thyristors
- Understand the basic measurement and instrumentation based devices

**TEXTBOOKS**

1. Kothari DP and I.J Nagrath, "Basic Electrical and Electronics Engineering", McGraw Hill Education , 2nd Edition, 2020.
2. S.K.Bhattacharya, "Basic Electrical and Electronics Engineering", Pearson Education, 2nd Edition, 2017.

**REFERENCES**

1. H.S. Kalsi, "Electronic Instrumentation and Measurements", Tata McGraw-Hill, 4th Edition , 2019.
2. Murugesh Kumar, "Electric Machines", Vikas Publishing House Pvt. Ltd, 2002

**E-RESOURCES**

1. https://archive.nptel.ac.in/courses/108/106/108106172/ (Basic Electrical Circuits)
2. https://archive.nptel.ac.in/courses/108/102/108102146/ (Electrical Machines)

**19CSE201** **C PROGRAMMING** **L T P C**
(Lab Embedded Theory Course) **3 0 2 4**

**OBJECTIVES**

The main objectives of this course are, to

- Develop C Programs using basic programming constructs.
- Demonstrate C programs using arrays and strings.
- Know the applications in C using functions and pointers.
- Understand the structures and Unions.
- Construct input/output and file handling programs in C and perform read and write operations on file.
- Apply the practical knowledge through the various concepts in C.

**UNIT I BASICS OF C PROGRAMMING** **9**

Introduction to programming paradigms – Structure of C program – C programming: Data Types– variables–Storage classes – Constants – Enumeration Constants – Keywords – Operators: Precedence and Associativity – Expressions –Input/Output statements, Assignment statements – Decision making statements – Switch statement – Looping statements – Pre- processor directives – Compilation process.

**UNIT II ARRAYS AND STRINGS** **9**

Introduction to Arrays: Declaration, Initialization – One dimensional array – Example Program**:** Computing Mean, Median and Mode – Two dimensional arrays – Example Program: Matrix Operations (Addition, Scaling, Determinant and Transpose) – String operations: length, compare, concatenate, copy –Sorting – Selection sort, Insertion sort, Merge sort, quick sort – Searching — linear and binary search.

**UNIT III FUNCTIONS AND POINTERS** **9**

Introduction to functions: Function prototype, function call, Built–in functions (string functions,math functions) – Recursion – Example Program: Computation of Sine series, Scientific calculator using built-in functions — Pointers — Pointer operators — Arrays and pointers — Example Program: Sorting of names – Parameter passing: Pass by value, Pass by reference – Example Program: Swapping of two numbers and changing the value of a variable using passby reference.

**UNIT IV STRUCTURES** **9**

Structure – Example Programs – Nested structures – Pointer in Structures – Array of structures —Example Program using structures and pointers – Self referential structures – Dynamic memory allocation.

**UNIT V FILE PROCESSING** **9**

Files – Operations of File – Types of file processing: Sequential access, Random access – Sequential access file – Random access file – Command line arguments.

**LABORATORY PART**

**LIST OF EXPERIMENTS**

(Any Eight Experiments to be conducted)

1. Programs using I/O statements, expressions and decision–making constructs.
2. Write a program to find whether the given year is leap year or Not.
3. Design a calculator to perform the operations, namely, addition, subtraction, multiplication, division and square of a number.
4. Check whether a given number is Armstrong number or not?
5. Given a set of numbers like <10, 36, 54, 89, 12, 27>, find sum of weights based on thefollowing conditions.
    a) 5 if it is a perfect cube.
    b) 4 if it is a multiple of 4 and divisible by 6.
    c) 3 if it is a prime number.
6. Sort the numbers based on the weight in the increasing order as shown below <10,its weight>, <36,its weight> <89,its weight>
7. Populate an array with height of persons and find how many persons are above the average height.
8. From a given paragraph perform the following using built–in functions:(i)Find the total number of words.(ii)Capitalize the first word of each sentence.(iii)Replace a given word with another word.
9. Solve towers of Hanoi using recursion.
10. Locate and Display the Contents of an Array using Pointers.
11. Generate salary slip of employees using structures and pointers.
12. Count the number of account holders whose balance is less than the minimum balance using sequential access file.

**TOTAL: 45 +15 = 60 PERIODS**

**OUTCOMES**

Upon completion of the course, the students will be able to,

- Develop C programs for simple applications making use of basic constructs,
- Implement C programs for simple applications making use of basic arrays and strings.
- Construct C programs involving functions, recursion and pointers
- Write C programs using structures.
- Design applications using sequential and random access file processing.
- Do problem solving by applying various programming methodologies.

**TEXT BOOKS**

1. E.Balagurusamy,"Programming in ANSI C", Tata McGraw Hill, 8th Edition, 2019.
2. Kernighan, B.W and Ritchie,D.M,"The C Programming language", 2nd Edition, PearsonEducation, 2006.

**REFERENCES**

1. ReemaThareja, "Programming in C", Oxford University Press, 2nd Edition, 2016.
2. Juneja, B. L and Anita Seth, "Programming in C", CENGAGE Learning India pvt.Ltd.,2011.

**E – RESOURCES**

1. https://nptel.ac.in/courses/106/105/106105085/ (Introduction to C Programming)
2. https://nptel.ac.in/courses/106/106/106106210/ (Stack Operations)

| 19EEC202 | TECHNICAL SKILL (MULTIMEDIA)<br>(Employability Enhancement Course) | L T P C<br>0 0 2 0 |
|---|---|---|

**OBJECTIVES**

The main objective of this course is, to

- Explore the various multimedia editing tools like Flash and Photoshop.
- Know about the multimedia software tools and can interact with multimedia practically.
- Know the animation techniques in Flash.
- Enable to understand layers in Photoshop.
- Enhance the skills to do image processing.
- Exploit animations and games.

**LIST OF TECHNICAL SKILLS TO BE LEARNED**

**Flash:**

1. To create an animation to represent the growing moon.
2. To create an animation to indicate a ball bouncing on steps.
3. To change a circle into a square using flash.
4. To display the background given(filename: tulip.jpg) through your name.
5. To draw the fan blades and to give proper animation.

**Photoshop:**

6. To Design a visiting card containing atleast one graphic and text information.
7. To preparea cover page for thebook in your subject area. plan your own design.
8. To adjust the brightness and contrast of the picture so that it gives an elegant look.
9. To use appropriate tool(s) from the toolbox, cut the objects from 3 files. (f1.jpg, f2.jpg & f3.jpg); organise them in a single file and apply feather effects.
10. Apply crop, canvas and clone tools in an image.

**TOTAL: 20 PERIODS**

**OUTCOMES**

Upon completion of the course, the students will be able to,

- Apply the tools on Photoshop.
- Create an application using Photoshop.
- Process the element using flash.
- Create animations.
- Understand the process of image processing.

**SEMESTER III**

| | | |
|---|---|---|
| **19MAT301** | **TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS** | **L T P C** |
| | (Common to Civil, CSE) | **3 1 0 4** |

**OBJECTIVES**

The main objective of this course is to:

- Discover the basic concepts of Partial differential equation for solving standard partial differential equations.
- Apply the Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- Acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
- Explain Fourier transform techniques used in wide variety of situations.
- Utilize the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

**UNIT I PARTIAL DIFFERENTIAL EQUATIONS 9+3**

Formation of partial differential equations - Singular integrals - Solutions of standard types of first order partial differential equations - Lagrange's linear equation - Linear partial differential equations of second and higher order with constant coefficients of homogeneous types.

**UNIT II FOURIER SERIES 9+3**

Dirichlet's conditions - General Fourier series - Odd and even functions - Half range Sine and Cosine series - Parseval's identity - Harmonic analysis.

**UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 9+3**

Classification of partial differential equations - Method of separation of variables - Fourier Series Solutions of one dimensional wave equation - One dimensional equation of heat conduction - Steady state solution of two dimensional equation of heat conduction.

**UNIT IV FOURIER TRANSFORMS 9+3**

Statement of Fourier integral theorem - Fourier transform pair - Fourier sine and cosine transforms - Properties - Transforms of simple functions - Convolution theorem -Parseval's identity.

**UNIT V Z - TRANSFORMS AND DIFFERENCE EQUATIONS 9+3**

Z-transforms - Elementary properties - Inverse Z-transform (using partial fraction and residues) -Initial and final value theorems - Convolution theorem - Solution of difference equations using Z - transform.

**TOTAL= 45+15=60 PERIODS**

## OUTCOMES

Upon completion of this course, the students will be able to :

- Use the standard types of partial differential equations.
- Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.
- Relate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.
- Analyze some of the physical problems of engineering by Fourier transforms.
- Apply Z transforms techniques in solving difference equation.

## TEXT BOOKS

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. Narayanan S., Manicavachagom Pillay.T.K and Ramanaiah.G., "Advanced Mathematics for Engineering Students", Vol. II & III, S.Viswanathan Publishers Pvt. Ltd, Chennai, 1998.

## REFERENCES

1. N.P. Bali. and Manish Goyal, "A Textbook of Engineering Mathematics", 9th Edition, Laxmi Publications Pvt. Ltd, 2014.
2. Erwin Kreyszig, "Advanced Engineering Mathematics ",10th Edition, John Wiley,India,2016.

## E-RESOURCES

1. https://nptel.ac.in
2. https://swayam.gov.in/nd1_noc19_ma22/preview

**19CST301** **DATA STRUCTURES** **L T P C**
**3 0 0 3**

**OBJECTIVES**

The main objective of the course is, to

- Understand the concepts of ADTs.
- Learn linear data structures – lists, stacks, and queues.
- Understand sorting algorithms.
- Apply Tree and Graph structures.
- Analyze searching and hashing techniques.

**UNIT I LINEAR DATA STRUCTURES – LIST 9**

Abstract Data Types (ADTs) – List ADT – array-based implementation – linked list implementation – singly linked lists – circularly linked lists – doubly linked lists – applications of lists – Polynomial Manipulation – All operations (Insertion, Deletion, Merge, Traversal).

**UNIT II LINEAR DATA STRUCTURES – STACKS, QUEUES 9**

Stack ADT – Operations – Applications – Evaluating arithmetic expressions – Conversion of Infix to postfix expression – Queue ADT – Operations – Circular Queue – Priority Queue – deQueue – applications of queues.

**UNIT III NON LINEAR DATA STRUCTURES – TREES 9**

Tree ADT – tree traversals – Binary Tree ADT – expression trees – applications of trees – binary search tree ADT –Threaded Binary Trees – AVL Trees – B-Tree – B+ Tree – Red-Black trees – Splay trees – Heap – Applications of heap.

**UNIT IV NON LINEAR DATA STRUCTURES – GRAPHS 9**

Definition – Representation of Graph – Types of graph – Breadth-first traversal – Depth-first traversal – Topological Sort – Minimum Spanning Trees – Kruskal and Prim algorithm – Shortest path algorithm – Dijkstra"s algorithm – Floyd-Warshall algorithm. Bi-connectivity – Cut vertex – Euler circuits – Applications of graphs.

**UNIT V SEARCHING, SORTING AND HASHING TECHNIQUES 9**

Searching – Linear Search – Binary Search. Sorting – Bubble sort – Selection sort – Insertion sort – Shell sort – Radix sort. Hashing – Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing.

**TOTAL: 45 PERIODS**

**OUTCOMES**

At the end of the course, the student should be able to,

- Implement abstract data types for linear data structures.
- Apply the different linear and non-linear data structures to problem solutions.
- Identify the type of tree and understand various tree concepts.
- Apply the hashing techniques to organize memory
- Analyze the various searching algorithms.

**TEXT BOOKS**

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education,1997.
2. ReemaThareja, "Data Structures Using C", 2nd Edition , Oxford University Press, 2011.

**REFERENCES**

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, "Introduction to Algorithms", 2nd Edition, Mcgraw Hill, 2002.
2. Aho, Hopcroft and Ullman, "Data Structures and Algorithms", Pearson Education,1983.

**E – RESOURCES**

1. https://nptel.ac.in/courses/106/102/106102064/ (Introduction to Data Structures and Algorithms)
2. https://nptel.ac.in/courses/106/103/106103069/ (Searching and Sorting)

**19ADT301 FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE L T P C**
**3 0 0 3**

**OBJECTIVES**

The main objective of the course is to,

- Understand the various characteristics of intelligent systems.
- Learn different search methods in Artificial Intelligence.
- Learn representation of knowledge in solving AI problems.
- Know the different ways of designing software agents.
- Know about the various applications of AI.

**UNIT I INTELLIGENT AGENTS 9**

Introduction to AI – Agents and Environments – concept of rationality – nature of environments – structure of agents. Problem solving agents – search algorithms – uninformed search strategies.

**UNIT II PROBLEM SOLVING 9**

Heuristic search strategies – heuristic functions. Local search and optimization problems – local search in continuous space – search with non-deterministic actions – search in partially observable environments – online search agents and unknown environment

**UNIT III GAME PLAYING AND CSP 9**

Game theory – optimal decisions in games – alpha-beta search – monte -carlo tree search – stochastic games . Constraint satisfaction problems – constraint propagation – backtracking search for CSP – local search for CSP – structure of CSP

**UNIT IV LOGICAL REASONING 9**

Knowledge-based agents – propositional logic – propositional theorem proving – propositional model checking – agents based on propositional logic. First-order logic – syntax and semantics – knowledge representation and engineering – forward chaining – backward chaining – resolution.

**UNIT V PROBABILISTIC REASONING 9**

Acting under uncertainty – Bayesian inference – naïve Bayes models. Probabilistic reasoning – Bayesian networks – exact inference in BN – approximate inference in BN – causal networks.

**TOTAL : 45 PERIODS**

**OUTCOMES**

Upon completion of the course, the students will be able to,

- Study the software architecture and its quality attributes.
- Use appropriate search algorithm for any AI problems.
- Represent a problem using Propositional and First Order Logic.
- Design software agents to solve a problem.
- Design various applications that use Artificial Intelligence.

**TEXT BOOKS**

1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach", 4th Edition, Prentice Hall, 2020.
2. M. Tim Jones, "Artificial Intelligence: A Systems Approach (Computer Science)", 1st Edition,Jones and Bartlett Publishers, Inc. , 2008.

**REFERENCES**

1. Gerhard Weiss, "Multi Agent Systems", 2nd Edition, MIT Press, 2013.
2. David L. Poole and Alan K. Mackworth, "Artificial Intelligence: Foundations of Computational Agents", 1st Edition,Cambridge University Press, 2010.

**E – RESOURCES**

1. https://nptel.ac.in/courses/106/105/106105077 (Uninformed Search)
2. https://nptel.ac.in/courses/106/106/106106126 (Propositional and First Order Logic)

**19ECE304 DIGITAL PRINCIPLES AND COMPUTER ARCHITECTURE L T P C**
**3 0 0 3**

**OBJECTIVES**

- To analyze and design combinational circuits.
- To analyze and design sequential circuits
- To understand the basic structure and operation of a digital computer.
- To study the design of data path unit, control unit for processor.
- To familiarize with the hazards.
- To understand the concept of various memories and I/O interfacing.

**UNIT I COMBINATIONAL LOGIC 9**

Combinational Circuits – Karnaugh Map - Analysis and Design Procedures – Binary Adder – Subtractor – Decimal Adder - Magnitude Comparator – Decoder – Encoder – Multiplexers - Demultiplexers

**UNIT II SYNCHRONOUS SEQUENTIAL LOGIC 9**

Introduction to Sequential Circuits – Flip-Flops – operation and excitation tables, Triggering of FF, Analysis and design of clocked sequential circuits – Design – Moore/Mealy models, state minimization, state assignment, circuit implementation - Registers – Counters.

**UNIT III COMPUTER FUNDAMENTALS 9**

Functional Units of a Digital Computer: Von Neumann Architecture – Operation and Operands of Computer Hardware Instruction – Instruction Set Architecture (ISA): Memory Location, Address and Operation – Instruction and Instruction Sequencing – Addressing Modes, Encoding of Machine Instruction – Interaction between Assembly and High Level Language.

**UNIT IV PROCESSOR 9**

Instruction Execution – Building a Data Path – Designing a Control Unit – Hardwired Control, Microprogrammed Control – Pipelining – Data Hazard – Control Hazards.

**UNIT V MEMORY AND I/O 9**

Memory Concepts and Hierarchy – Memory Management – Cache Memories: Mapping and Replacement Techniques – Virtual Memory – DMA – I/O – Accessing I/O: Parallel and Serial Interface – Interrupt I/O – Interconnection Standards: USB, SATA

**TOTAL: 45 PERIODS**

**LABORATORY PART**

**LIST OF EXPERIMENTS**

(Any Eight Experiments to be conducted)

1. Verification of Boolean theorems using logic gates.
2. Design and implementation of combinational circuits using gates for arbitrary functions.
3. Implementation of 4-bit binary adder/subtractor circuits.
4. Implementation of code converters.
5. Implementation of BCD adder, encoder and decoder circuits
6. Implementation of functions using Multiplexers.
7. Implementation of the synchronous counters
8. Implementation of a Universal Shift register.
9. Simulator based study of Computer Architecture

**OUTCOMES**

On Completion of the course, the students should be able to,

- Design various combinational digital circuits using logic gates
- Design sequential circuits and analyze the design procedures
- State the fundamentals of computer systems
- Analyze the execution of an instruction
- Analyze different types of control design and identify hazards
- Identify the characteristics of various memory systems and I/O communication

**TEXT BOOKS**

1. M. Morris Mano, Michael D. Ciletti, "Digital Design : With an Introduction to the Verilog HDL, VHDL, and System Verilog", Sixth Edition, Pearson Education, 2018.
2. David A. Patterson, John L. Hennessy, "Computer Organization and Design, The Hardware/Software Interface", Sixth Edition, Morgan Kaufmann/Elsevier, 2020.

**REFERENCES**

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, "Computer Organization and Embedded Systems", Sixth Edition, Tata McGraw-Hill, 2012.

2. William Stallings, "Computer Organization and Architecture – Designing for Performance", Tenth Edition, Pearson Education, 2016.
3. M. Morris Mano, "Digital Logic and Computer Design", Pearson Education, 2016.

**E – RESOURCES**

1. https://nptel.ac.in/courses/117/106/117106086/ (Digital Design)
2. https://www.digimat.in/nptel/courses/video/106101060(Pipelining)

**19CSE401 DATABASE MANAGEMENT SYSTEMS L T P C**
**3 0 2 4**

**OBJECTIVES**

The main objective of the course is to,

- Learn the fundamentals of data models and to represent a database system using ER diagrams.
- Study SQL and relational database design.
- Understand the internal storage structures using different file and indexing techniques which will help in physical DBdesign.
- Understand the fundamental concepts of transaction processing– concurrency control techniques and recovery procedures.
- Acquire a knowledge about the Storage and Query processing Techniques.
- Provide a practical knowledge about various commands and procedures in a RDBMS.

**UNIT I RELATIONAL DATABASES 10**

Introduction :Database System Application – Purpose of Database System – Views of data – Data Models – Database System Architecture – Introduction to relational databases – Relational Model – Keys – Relational Algebra – SQL fundamentals – Embedded SQL– Dynamic SQL.

**UNIT II DATABASE DESIGN 9**

Entity-Relationship model — E-R Diagrams — Enhanced E-R Model — ER Design Issues — Functional Dependencies – Non-loss Decomposition – First, Second, Third Normal Forms Boyce/CoddNormal Form – Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form.

**UNIT III TRANSACTIONS 9**

Transaction Concepts – ACID Properties – Schedules – Serializability – Concurrency Control – Need for Concurrency – Locking Protocols – Two Phase Locking – Deadlock – Transaction Recovery – Save Points – SQL Facilities for Concurrency and Recovery.

**UNIT IV IMPLEMENTATION TECHNIQUES 8**

Overview of Physical Storage Media — Magnetic Disks — RAID — File Organization —

Organization of Records in Files – Indexing and Hashing – Ordered Indices – B+ tree Index Files— Static Hashing — Dynamic Hashing — Query Processing Overview — Measure the Cost Estimation.

**UNIT V ADVANCED TOPICS** **9**

Distributed Databases: Architecture, Data Storage, Transaction Processing – Object-based Databases: Object Database Concepts, Object-Relational features – XML Databases: XML Hierarchical Model, purpose of XML – Information Retrieval: IR Concepts and Advantages.

**LABORATORY PART**

**LIST OF EXPERIMENTS**

(Any Eight Experiments to be conducted)

1. Data Definition Commands, Data Manipulation Commands for inserting, deleting,updating and retrieving Tables and Transaction Control statements.
2. Implement Relational model to entitle ann strong and weak entities.
3. Database Querying – Simple queries, Nested queries, Sub queries and Joins.
4. Views, Sequences, Synonyms.
5. Database Programming: Implicit and Explicit Cursors.
6. Procedures and Functions.
7. Triggers.
8. Exception Handling.
9. Database Design using ER modelling, normalization and Implementation for any application.
10. Database Connectivity with Front End Tools.
11. Case Study using real life database applications.

**TOTAL : 45+15 = 60 PERIODS**

**OUTCOMES**

Upon completion of the course, the students will be able to,

- Use typical data definitions and manipulation commands.
- Design applications to test Nested and Join Queries.
- Implement simple applications that use Views.
- Implement applications that require a Front–end Tool.

- Analyze the use of Tables, Views, Functions and Procedures.
- Gather a practical knowledge about various commands and procedures in a RDBMS.

**TEXT BOOKS**

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", 6th Edition, Tata McGraw Hill, 2011.
2. Ramez Elmasri,Shamkant B.Navathe," Fundamentals of Database Systems", 6th Edition, Pearson Education, 2011.

**REFERENCES**

1. C.J.Date,A.Kannan,S.Swamynathan,"An Introduction to Database Systems", 8th Edition, Pearson Education, 2006.
2. Raghu Ramakrishnan, "Database Management Systems", 4th Edition, McGraw–Hill College Publications, 2015.

**E – RESOURCES**

1. https://nptel.ac.in/courses/106/105/106105175/ (Introduction to DBMS)
2. https://nptel.ac.in/courses/106/106/106106093/ (Conceptual Designs)

**19ADE301** **JAVA PROGRAMMING** **L T P C**
**3 0 2 4**

**OBJECTIVES**

The main objective of the course is to,

- Gain knowledge about basic Java language syntax and semantics to write Java programs and use concepts such as variables, conditional and iterative execution methods etc.
- Understand the fundamentals of object-oriented programming in Java, including defining classes, objects, invoking methods etc and exception handling mechanisms.
- Understand the principles of inheritance, packages and interfaces.
- Understand the basics of Exception Handling &Multi threading
- Know how to handle events.
- Familiarize with all the concepts in Java.

**UNIT I INTRODUCTION TO JAVA 9**

History of Java – Difference between C++ and Java = Byte Code – The Java Buzz Words - Compiling and Running Java Program – Data Types – Variables – Type Conversion and Casting Arrays : One Dimensional – Multi Dimensional – Alternate Array Declaration -Operators – Control Statements : Selection (if, switch), Iteration Statements(while, do-while, for , nested loops)- Jump Statements(break, continue, return.

**UNIT II EXCEPTION HANDLING 9**

Exception fundamentals – uncaught exception – exception types – exception hierarchy- using try and catch – multiple catch blocks – throw, throws, finally – user defined exception

**UNIT III MULTITHREADED PROGRAMMING 9**

Java Thread Model – Main Thread – Creating Thread – Thread Methods – Thread priorities – Creating multiple threads – isAlive() and join()- Thread Synchronization – Interthread Communication

**UNIT IV STRING HANDLING AND IO STREAMING 9**

**String Handling:**

String Constructors - String concatenation with other data types – Character Extraction Methods – String Comparison - Modifying a String – Searching String – StringBuffer – Wrapper Classes(Integer, Float, Double, Number, Character, Boolean)

**IOStreaming**

Character Streams and Byte Streams – Reading and Writing Characters and Strings – Reading and Writing Files

**UNIT V EVENT HANDLING 9**

The Delegation Event Model – Event Classes – Event Listener Interfaces - Layout Managers (Flow, Border, Grid and GridBagLayouts) - Handling Mouse Events - Introduction to Swing – JFrame, JTextField, JButton, JTextArea, JComboBox, JTahhedPane, JScrollPane

**LABORATORY PART**

**LIST OF EXPERIMENTS**

(Any Eight Experiments to be conducted)

1. Write a Java program to check whether the given string is palindrome or not.
2. Develop a Java application to generate Electricity bill.
3. Develop a java application to implement currency converter using packages
4. Design a Java interface for ADT Stack. Implement this interface using array.
5. Write a program to perform string operations using Array List.
6. Write a Java program to implement user defined exception handling.
7. Write a java program that implements a multi–threaded application.
8. Write a java program to find the maximum value from the given type of elements using a generic function.
9. Develop a mini project for any application using Java concepts.

**TOTAL : 45+15 = 60 PERIODS**

**OUTCOMES**

Upon completion of the course, the students will be able to,

- Write Java application programs using OOP principles and proper program structuring
- Demonstrate the concepts of Packages and inheritance
- Write Java programs to implement error handling techniques using exception handling
- Develop application using multi threading
- Write a event based java program

**TEXT BOOKS**

1. Herbert Schildt, "Java The complete reference", 11th Edition, McGraw Hill Education, 2019.

2. Cay S. Horstmann, Gary cornell, "Core Java Volume –I Fundamentals", 11th Edition, Prentice Hall

**REFERENCES**

1. Paul Deitel, Harvey Deitel, "Java SE 8 for programmers", 3rd Edition, Pearson, 2015.
2. Steven Holzner, "Java 2 Black book", Dreamtech press, 2011.
3. Timothy Budd, "Understanding Object-oriented programming with Java", Updated Edition,Pearson Education, 2000.

**E – RESOURCES**

1. https://nptel.ac.in/courses/106/105/106105191/ (Programming in Java)
2. https://nptel.ac.in/courses/106/105/106105191/ (Inheritance)

**19EEC301** **COMMUNICATION SKILLS** **L T P C**
**0 0 2 0**

**OBJECTIVES**

The purpose of learning this course is to

- Improve fluency in English through well developed vocabulary.
- Develop the oral communication skills.
- Focus the effective reading of general and technical text.
- Enrich writing skill.
- Communicate ideas in group discussion and interviews.

**UNIT I VOCABULARY** **6**

Vocabulary building – articulate ideas and thoughts; usage of palindromes,greetings, wishes, festival related words – homophones and homonyms – connotation – vocabulary words with sentences. – Idiomatic Expressions – One-word Substitutes.

Activities: Learn a word a week, Use newspaper to write unfamiliar words, Word association games.

**UNIT II LISTENING** **6**

Listening Skill — Its importance — Purpose — Process– Types — Barriers — Effective Listening strategies – Listening to telephonic conversations – Ted talks – Watching Inspiring Speech videos on You tube – Listening native speaker's videos for pronunciation- Listening to broadcast, messages, announcements - Listening to Instagram Videos.

Activities:Listen and draw the different scenes in a story, Secret Message games,watching videos and listing difficult words.

**UNIT III SPEAKING** **6**

JAM Talk – Role play – Debate – Conversational skills (formal and informal) – Conversation practice – group discussion and interview skills – Introducing oneself and others – Presentation skills – Making presentations (individual and group) through seminars / PPTs.

Activities: Picture Description, Giving Directions and Guidelines, Making a short speech — Extempore

**UNIT IV READING** **6**

Strategies for effective reading (Guessing meanings from contexts — Scanning, skimming, inferring meaning and critical reading) — Read and recognize different text types ranging from

newspaper articles, magazines, books, Technical articles and Reading autobiographies.

Activities:Reading online sources like e-books, e-journals and e-newspapers,cloze exercises,Reading and answering questions.

**UNIT V WRITING** **6**

Develop a paragraph: topic sentence, supporting sentences, concluding sentence – Writing simple Essays – argument, descriptive and comparative essays – Creative writing.

Activities: Write Essays with sub titles,Write a story that uses as many clichés and idioms, Write Paragraph.

**TOTAL : 30 PERIODS**

The following Practice Session will be conducted for the Communication Skills (CS) Labsessions:

- Activities on Presentations Skills – Students make presentations on given topics.
- Activities on Group Discussion – Students participate in group discussions.
- Interview Skills – Students participate in Mock Interviews.
- Essay Writing – Students prepare their own paragraph and essay.

**Guidelines for conducting assessments as per 2019 regulations**

- 30 hours – Two consecutive hours allotted for each class.
- Three Continuous assessments only conducted and no end semester exam.
- For the award of Continuous assessment the best three activities from Essay Writing,Oral Presentation, Extempore,Group Discussion and Mock Interview (one –on – one basis) can be taken.

**OUTCOMES**

At the end of this course, learners will be able to

- Improve vocabulary and express the same contextually.
- Comprehend the general and technical text.
- Communicate to his peer group properly and make presentations.
- Write simple paragraph and essay in any topic.
- Participate in group discussions expressing ideas relevantly, coherently and cogently.

**TEXT BOOKS**

1. Gramer F. Margot and Colin S. Ward,"Reading and Writing (Level 3)", Oxford University Press: Oxford, 2011

2. Brooks,Margret,"Skills for Success. Listening and Speaking. Level 4", Oxford University Press, Oxford, 2011

**REFERENCES**

1. Davis, Jason and Rhonda LIss,"Effective Academic Writing (Level 3)", Oxford University Press: Oxford, 2006.
2. E. Suresh Kumar and et al.,"Enriching Speaking and Writing Skills",2nd Edition,Orient Black swan.

**E – RESOURCES**

1. www.youglish.com (Introduction )
2. www.Newwellington University.com (Reading and Writing)

| 19MDC301 | LEADERSHIP ENHANCEMENT PROGRAMME<br>(Common to all branches) | L T P C<br>1 0 0 0 |
|---|---|---|

**OBJECTIVES**

The objective of the course is enabling the students to,

- Find new, innovative ways of developing and managing people.
- Develop new business opportunities.
- Tackle the broader societal issues the face.
- Key benefits of leadership skills in different situations.
- formulate and implement effective leadership strategies.

**TOPICS TO BE COVERED**

1. Leadership for an Engineering students: Skills & Strategies.
2. Qualities of good leaders and 21 irrefutable laws of Leadership.
3. Empowering Others and Managing People.
4. Leading Meetings.
5. Leadership competencies and Leadership Styles.
6. Difference between a boss and a leader.
7. Leadership and Assertiveness Skills : A Good Leader, Leadership Theories, Leadership Behaviour , Assertiveness skills.
8. Leadership development opportunities and suggestions.
9. Teamwork and Leadership : Concept of teams , Building Effective teams, Concept of leadership and sharpening leadership skills.
10. Teamwork and Leadership Activities : Group discussion, Solving Puzzle as a team, describing a leadership style.

**TOTAL : 12 PERIODS**

**OUTCOMES**

At the end of the course, the students will be able to,

- Develop the capabilities needed to increase team's work productivity.
- Help to decrease employee turnover and increase engagement, creating a strong and united team.
- Develop communication skills, mastering the art of negotiation, influence and conflict management.
- More confident as a leader and find new ways of influencing the teams they lead.

- Effectively connect to people, developing the ability to give constructive feedback, and critically seek the feedback of the team.

**TEXT BOOKS**

1. John maxwell, "21 Irrefutable Laws of Leadership", 2008.
2. Louis carter ,David ulrich , Marshall goldsmith,"Best practices in leadership development and Organization change".

**REFERENCES**

1. Barry Benator, Albert Thumann,"Project Management and Leadership Skills for Engineering and Construction Projects", 2003.
2. Sydänmaanlakka Pentti. "Intelligent leadership and leadership competencies". Dissertation Series.

**E – RESOURCES**

1. https://nptel.ac.in/courses/122/105/122105021/ (Introduction to Leadership)
2. www.ccl.org/leadership/research/index.aspx. (Leadership and Assertive Skills)

**SEMESTER IV**

**19MAT406 ESSENTIAL MATHEMATICS FOR MACHINE LEARNING L T P C**

**4 0 0 4**

**OBJECTIVES**

The main objective of this course is to:

- Provide the required mathematical support in real life problems and develop probabilistic models which can be used in several areas of Science and Engineering.
- Distinguish one and two dimensional random variables and to introducing some standard distributions
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To introduce the basic concepts of classifications of design of experiments which plays very important roles in the field of agriculture and statistical quality control.

**UNIT I PROBABILITY AND RANDOM VARIABLES 9+3**

Introduction to Probability - Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions

**UNIT II TWO – DIMENSIONAL RANDOM VARIABLES 9+3**

Joint distributions – Marginal and conditional distributions – Covariance – Correlation - Rank correlation and linear regression

**UNIT III TESTING OF HYPOTHESIS 9+3**

Sampling distributions-Estimation of parameters-Statistical hypothesis-Large sample test based on Normal distribution for single mean and difference of means

**UNIT IV TEST STATISTICS 9+3**

Tests based on t, $\chi^2$, z and F distributions for means ,variances and proportion – Contingency table (Test for Independent) – Goodness of fit.

**UNIT V ANALYSIS OF VARIANCE** **9+3**

One way and Two way classifications - Completely randomized design – Randomized block design – Latin square design

**TOTAL : 45+15 = 60 PERIODS**

**OUTCOMES**

Upon completion of this course, the students will be able to :

- Apply the fundamental ideas of probability concepts and to solve the standard distributions which can describe real life phenomenon.
- Distinguish the one and two dimensional random variables and apply in engineering applications.
- Apply the concept of testing of hypothesis for small and large samples in real life problems.
- Apply the basic concepts of classifications of design of experiments in the field of agriculture and statistical quality control.
- Have the notion of sampling distributions and statistical techniques used in engineering and management problems.

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**TEXT BOOKS**

1. Grewal B.S., 'Higher Engineering Mathematics', Khanna Publishers, New Delhi, 43rd Edition, 2014.

2. Kreyszig Erwin, "Advanced Engineering Mathematics ", John Wiley and Sons, 10th Edition, New Delhi, 2016

**REFERENCES**

1. Bali N., Goyal M. and Watkins C., 'Advanced Engineering Mathematics', Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009. 2.

2.Jain R.K. and Iyengar S.R.K.,' Advanced Engineering Mathematics ', Narosa Publications, New Delhi , 3rd Edition, 2007.

**E–RESOURCES**

1.https://nptel.ac.in/courses/111/106/111106053/ (Review of Set Theory)

2.https://swayam.gov.in/nd1_noc19_ma22/preview (Higher Engineering Mathematics)

**19CST401 DESIGN AND ANALYSIS OF ALGORITHMS L T P C**
**3 1 0 4**

**OBJECTIVES**

The objective of the course is enabling the students to,

- Understand and apply the algorithm analysis techniques.
- Analyze the efficiency of alternative algorithmic solutions for the same problem.
- Understand different algorithm design techniques.
- Understand the limitations of Algorithmic power.
- Solve P and NP complete problems.

**UNIT I INTRODUCTION 9+3**

Notion of an Algorithm – Fundamentals of Algorithmic Problem Solving – Important Problem Types – Fundamentals of the Analysis of Algorithm Efficiency – Asymptotic Notations and its properties. Analysis Framework – Empirical Analysis – Mathematical analysis for Recursive and Non–recursive algorithms – Visualization.

**UNIT II BRUTE FORCE AND DIVIDE–AND–CONQUER 9+3**

Brute Force — Computing an String — String Matching — Closest — Pair and Convex — Hull Problems — Exhaustive Search — Traveling Salesman Problem — Knapsack Problem — Assignment problem. Divide and conquer methodology – Binary search– Merge sort – Quick sort – Heap Sort – Multiplication of Large Integers – Closest–Pair and Convex–Hull Problems.

**UNIT III DYNAMIC PROGRAMMING AND GREEDY TECHNIQUE 9+3**

Dynamic programming – Principle of optimality – Coin changing problem – Computing a Binomial Coefficient – Floyd's algorithm – Multi Stage Graph – Optimal Binary Search Trees – Knapsack Problem and Memory functions. Greedy Technique – Container Loading Problem – Prim's algorithm and Kruskal's Algorithm – 0/1 Knapsack Problem – Optimal Merge Pattern – Huffman Trees.

**UNIT IV ITERATIVE IMPROVEMENT 9+3**

The Simplex Method –The Maximum-Flow Problem – Maximum Matching in BipartiteGraphs –The

Stable marriage Problem.

**UNIT V COPING WITH THE LIMITATIONS OF ALGORITHM POWER 9+3**

Lower-Bound Arguments – P, NP NP-Complete and NP Hard Problems – n-Queen Problem – Hamiltonian Circuit Problem – Subset Sum Problem. Branch and Bound – LIFO Search and FIFO Search – Assignment problem – Knapsack Problem – Traveling Salesman Problem.

**TOTAL:45+15= 60 PERIODS**

**OUTCOMES**

Upon completion of the course, Students will be able to,

- Design algorithms for various computing problems.
- Analyze the time and space complexity of algorithms.
- Critically analyze the different algorithm design techniques for a given problem.
- Modify existing algorithms to improve efficiency.
- Solve P and NP Complete Problems.

**TEXT BOOKS**

1. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", 3rd Edition,Pearson Education, 2012.
2. Ellis Horowitz, SartajSahni and Sanguthevar Rajasekaran, "Computer Algorithms/C++", 2nd Edition, Universities Press, 2007

**REFERENCES**

1. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", 3rd Edition, PHI Learning Private Limited, 2012.
2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, Reprint 2006.

**E – RESOURCES**

1. https://nptel.ac.in/courses/106/101/106101060/ (Algorithm Analysis and Framework)
2. https://nptel.ac.in/courses/106/106/106106131/ (Searching and Sorting)

**19CST402 OPERATING SYSTEMS L T P C**
**3 1 0 4**

**OBJECTIVES**

The main objective of this course is to,

- Understand the basic concepts and functions of operating systems.
- Know Processes, Threads and to analyze Scheduling algorithms and Understand the concept of Deadlocks.
- Analyze various memory management schemes.
- Understand I/O management and File systems.
- Understand advanced operating systems.

**UNIT I OPERATING SYSTEM OVERVIEW 9+3**

Computer System Overview — Basic Elements, Instruction Execution, Interrupts, Memory Hierarchy, Cache Memory, Direct Memory Access, Multiprocessor and Multi core Organization. Operating system overview — objectives and functions, Evolution of Operating System.– Computer System Organization Operating System Structure and Operations — System Calls, System Programs, OS Generation and System Boot.

**UNIT II PROCESS MANAGEMENT 9+3**

Processes — Process Concept, Process Scheduling, Operations on Processes, Inter-process Communication; CPU Scheduling — Scheduling criteria, Scheduling algorithms, Multiple — processor scheduling, Real time scheduling; Threads — Overview, Multithreading models, Threading issues; Process Synchronization — The critical-section problem, Synchronization hardware, Mutex locks, Semaphores, Classic problems of synchronization, Critical regions, Monitors; Deadlock — System model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.

**UNIT III STORAGE MANAGEMENT 9+3**

Main Memory – Background, Swapping, Contiguous Memory Allocation, Paging, Segmentation, Segmentation with paging, 32 and 64 bit architecture Examples; Virtual Memory – Background, Demand Paging, Page Replacement, Allocation, Thrashing; Allocating Kernel Memory, OS Examples.

**UNIT IV FILE SYSTEMS AND I/O SYSTEMS 9+3**

Mass Storage system – Overview of Mass Storage Structure, Disk Structure, Disk Scheduling and Management, swap space management; File-System Interface — File concepts, Access methods, Directory Structure, Directory organization, File system mounting, File Sharing and Protection; File System Implementation — File System Structure, Directory implementation, Allocation Methods, Free Space Management, Efficiency and Performance, Recovery; I/O Systems — I/O Hardware, Application I/O interface, Kernel I/O subsystem, Streams, Performance.

**UNIT V CASE STUDY 9+3**

Linux System – Design Principles, Kernel Modules, Process Management, Scheduling, Memory Management, Input-Output Management, File System, Inter-process Communication; Mobile OS – iOS and Android – Architecture and SDK Framework, Media Layer, Services Layer, Core OS Layer, FileSystem.

**TOTAL : 45+15 = 60 PERIODS**

**OUTCOMES**

Upon completion of the course, Students will be able to,

- Analyze various scheduling algorithms.
- Understand deadlock prevention and avoidance algorithms.
- Compare and contrast various memory management schemes.
- Understand the functionality of file systems.
- Understand the advanced operating systems.

**TEXT BOOKS**

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne,"Operating System Concepts", 9th Edition, John Wiley and Sons Inc., 2012.
2. Harvey M. Deitel, "An introduction to Operating Systems", 3rd Edition, Addison– Wesley,2007.

**REFERENCES**

1. Ramaz Elmasri, A.Gil Carrick, David Levine, "Operating Systems – A Spiral Approach", Tata McGraw Hill Edition,2010.
2. Andrew S.Tanenbaum, "Modern Operating Systems", 2nd Edition, Pearson Education, 2004.

**E–RESOURCES**

1. https://nptel.ac.in/courses/106/105/106105214/ (Introduction to Operating Systems)
2. https://nptel.ac.in/courses/106/102/106102132/ (System Calls)

**19CST403 SOFTWARE ENGINEERING L T P C**
**3 0 0 3**

**OBJECTIVES**

The main objective of this course is to,

- Provide the understandings of the software engineering.
- Familiar with prototyping techniques for requirement engineering process.
- Address the design levels of software engineering.
- Develop the system from the scratch.
- Verify and validate the software.

**UNIT I INTRODUCTION 9**

Introduction – S/W Engineering Paradigm – life cycle models (water fall, incremental, spiral, WINWIN spiral, evolutionary, prototyping, object oriented) – system engineering – computer based system – verification – validation – life cycle process – development process – system engineering hierarchy.

**UNIT II PROJECT MANAGEMENT 9**

Project Management Concepts – Software Project Planning Risk analysis and management project scheduling and tracking – Software Quality Assurance – Software configuration management

**UNIT III REQUIREMENT ANALYSIS 9**

Functional and non-functional – user – system – Requirement Engineering process – feasibility studies – requirements elicitation – Validation and Management – Software Prototyping – Prototyping in the software process – rapid prototyping techniques – user interface prototyping – S/W document. Analysis and modeling – Data, Functional and Behavioural models – Structured Analysis and Data Dictionary.

**UNIT IV DESIGN AND DEVELOPMENT 9**

Design process and concepts — Modular design — Design heuristic — Design model and document. Architectural design — Data design — Architectural design — Transform and transaction mapping – User interface design – Component level design. Real time systems – Real time software design – System design – Introduction to Agility – Agile process – Extreme

programming — XP Process.

**UNIT V TESTING AND MAINTENANCE 9**

Taxonomy of software testing – levels – Black box testing – Testing boundary conditions – Structural testing – Test coverage criteria based on data flow mechanisms – Unit testing – Integration testing – Validation testing – system testing and debugging.Software Implementation Techniques: Coding practices – Refactoring – Maintenance and Reengineering – BPR model – Reengineering process model – Reverse and Forward Engineering.

**TOTAL :45 PERIODS**

**OUTCOMES**

Upon completion of the course, Students will be able to,

- Explore the strength and weakness of various life cycle models.
- Identify the functional and non–functional requirements for the project.
- Develop the project using lifecycle models.
- Understand the concepts of Agile.
- Verify and validate the software using different types of testing.

**TEXT BOOKS**

1. Roger Pressman.S, "Software Engineering : A Practitioner's Approach", 7th Edition, McGraw Hill, 2010.
2. Ian Sommerville,"Software Engineering ", 9th Edition, Pearson Education Asia, 2011.

**REFERENCES**

1. S.A. Kelkar, "Software Engineering, A Concise Study", Prentice Hall of India,2007
2. Carlo Ghezzi, MehdiJazayeri and Dino Mandrioli,"Fundamentals of Software Engineering", 2nd Edition, Prentice Hall of India, 2003.

**E – RESOURCES**

1. https://nptel.ac.in/courses/106/105/106105182/ (Software Models).
2. https://nptel.ac.in/courses/106/105/106105087/ (Structured Programming).

**19ADE401 FUNDAMENTALS OF DATA SCIENCE AND ANALYTICS** **L T P C**
**3 0 2 4**

**OBJECTIVES**

- To understand the techniques and processes of data science
- To apply descriptive data analytics
- To visualize data for various applications
- To understand inferential data analytics
- To analysis and build predictive models from data
- Provide a practical knowledge about various data analytics

**UNIT I INTRODUCTION TO DATA SCIENCE 8**

Need for data science – benefits and uses – facets of data – data science process – setting the research goal – retrieving data – cleansing, integrating, and transforming data – exploratory data analysis – build the models – presenting and building applications.

**UNIT II DESCRIPTIVE ANALYTICS 10**

Frequency distributions – Outliers –interpreting distributions – graphs – averages - describing variability – interquartile range – variability for qualitative and ranked data - Normal distributions – z scores – correlation – scatter plots – regression – regression line – least squares regression line – standard error of estimate – interpretation of $r^2$ – multiple regression equations – regression toward the mean.

**UNIT III INFERENTIAL STATISTICS 9**

Populations – samples – random sampling – Sampling distribution- standard error of the mean - Hypothesis testing – z-test – z-test procedure –decision rule – calculations – decisions – interpretations - one-tailed and two-tailed tests – Estimation – point estimate – confidence interval – level of confidence – effect of sample size.

**UNIT IV ANALYSIS OF VARIANCE 9**

t-test for one sample – sampling distribution of t – t-test procedure – t-test for two independent samples – p-value – statistical significance – t-test for two related samples. F-test – ANOVA – Two- factor experiments – three f-tests – two-factor ANOVA –Introduction to chi-square tests.

**UNIT V PREDICTIVE ANALYTICS 9**

Linear least squares – implementation – goodness of fit – testing a linear model – weighted resampling.

Regression using StatsModels – multiple regression –— logistic regression – estimating parameters – Time series analysis – moving averages – missing values – serial correlation – autocorrelation. Introduction to survival analysis.

**LABORATORY PART**

**LIST OF EXPERIMENTS**

**(**All Experiments to be conducted)

**Tools: Python, Numpy, Scipy, Matplotlib, Pandas, statmodels, seaborn, plotly, bokeh**

1. Working with Numpy arrays
2. Working with Pandas data frames
3. Basic plots using Matplotlib
4. Frequency distributions, Averages, Variability
5. Normal curves, Correlation and scatter plots, Correlation coefficient
6. Regression
7. Z-test
8. T-test

**TOTAL : 45+15 = 60 PERIODS**

**OUTCOMES:**

- Explain the data analytics pipeline
- Describe and visualize data
- Perform statistical inferences from data
- Analyze the variance in the data
- Build models for predictive analytics

## TEXT BOOKS

1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing Data Science", Manning Publications, 2016. (first two chapters for Unit I).
2. Robert S. Witte and John S. Witte, "Statistics", Eleventh Edition, Wiley Publications, 2017.

## REFERENCES

1. Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", Green Tea Press, 2014.

2. Sanjeev J. Wagh, Manisha S. Bhende, Anuradha D. Thakare, "Fundamentals of Data Science", CRC Press, 2022.

**E–RESOURCES**

1. https://nptel.ac.in/courses/108/105/106105219/ (Introduction data science)
2. https://nptel.ac.in/courses/108/102/106102132/ (time series)

**19ADE402 MACHINE LEARNING L T P C**
**3 0 0 3**

**OBJECTIVES**

- To understand the basic concepts of machine learning.
- To understand and build supervised learning models.
- To understand and build unsupervised learning models.
- To evaluate the algorithms based on corresponding metrics identified.
- Implement and demonstrate the algorithms to output a description of the set data.
- To understand Reinforcement Learning

## UNIT I INTRODUCTION TO MACHINE LEARNING 8

Review of Linear Algebra for machine learning; Introduction and motivation for machine learning; Examples of machine learning applications, Vapnik-Chervonenkis (VC) dimension, Probably Approximately Correct (PAC) learning, Hypothesis spaces, Inductive bias, Generalization, Bias variance trade-off.

## UNIT II SUPERVISED LEARNING 11

Linear Regression Models: Least squares, single & multiple variables, Bayesian linear regression, gradient descent, Linear Classification Models: Discriminant function – Perceptron algorithm, Probabilistic discriminative model– Naive Bayes, Maximum margin classifier – Support vector machine, Decision Tree, Random Forests

## UNIT III ENSEMBLE TECHNIQUES AND UNSUPERVISED LEARNING 9

Combining multiple learners: Model combination schemes, Voting, Ensemble Learning - bagging, boosting, stacking, Unsupervised learning: K-means, Instance Based Learning: KNN, Gaussian mixture models and Expectation maximization.

## UNIT IV NEURAL NETWORKS 9

Multilayer perceptron, activation functions, network training – gradient descent optimization – stochastic gradient descent, error backpropagation, from shallow networks to deep networks –Unit saturation (aka the vanishing gradient problem) – ReLU, hyperparameter tuning, batch normalization, regularization, dropout.

**UNIT V DESIGN AND ANALYSIS OF MACHINE LEARNING EXPERIMENTS 8**

Guidelines for machine learning experiments, Cross Validation (CV) and resampling – K-fold CV, bootstrapping, measuring classifier performance, assessing a single classification algorithm and comparing two classification algorithms – *t* test, McNemar's test, K-fold CV paired *t* test

## LABORATORY PART

## LIST OF EXPERIMENTS

(All Experiments to be conducted)

1. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
2. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
3. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.
4. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file and compute the accuracy with a few test data sets.
5. Implement naïve Bayesian Classifier model to classify a set of documents and measure the accuracy, precision, and recall.
6. Write a program to construct a Bayesian network to diagnose CORONA infection using standard WHO Data Set.
7. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using the k-Means algorithm. Compare the results of these two algorithms.
8. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions.

**TOTAL : 45+15 = 60 PERIODS**

**OUTCOMES**

- Explain the basic concepts of machine learning.
- Construct supervised learning models.
- Construct unsupervised learning algorithms.
- Evaluate and compare different models

- Construct k-Nearest Neighbour algorithm.

**TEXTBOOKS**

1. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Fourth Edition, 2020.
2. Stephen Marsland, "Machine Learning: An Algorithmic Perspective, "Second Edition", CRC Press, 2014.

**REFERENCES**

1. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.
2. Tom Mitchell, "Machine Learning", McGraw Hill, 3rd Edition, 1997.

**E–RESOURCES**

1. https://nptel.ac.in/courses/106/105/106105152/ (Different Types of Learning)
2. https://nptel.ac.in/courses/106/106/106106202/ (Learning Problem)

**19EEC302** **ENTREPRENEURSHIP DEVELOPMENT ACTIVITY** **LT P C**

(Common to Civil,CSE,ECE,EEE & Mechanical) **0 0 2 0**

**OBJECTIVES**

The Objectives are enabling the students to,

- Evaluate social and civil responsibilities of business ownership.
- Describe typical behavioral characteristics of an effective entrepreneur.
- Develop a business plan, including identifying an executive summary; conducting a marketing and competitive analysis report; and developing a marketing, management, and financial plan.
- Determine career opportunities, responsibilities, and educational and credentialing requirements related to various entrepreneurship ventures.
- Interpret research data to determine market–driven problems faced by entrepreneurs.

**TOPICS TO BE COVERED**

1. Should You Become an Entrepreneur?
   - Entrepreneurship: Present & Past
   - Is Entrepreneurship Right for You
   - Identify Business Opportunities & Set Goals
2. What Skills Do Entrepreneurs Need
   - Communication Skills
   - Math Skills
   - Problem Solving Skills
3. Entrepreneurs in a Market Economy
   - What is an Economy?
   - The Concept of Cost
   - Government in a Market Economy
4. Select a Type of Ownership
   - Run an Existing Business
5. Own a Franchise or Start a Business
   - Choose the Legal Form of Your Business

6. Develop a Business Plan
    - Why Do You Need a Business Plan
    - What Goes into a Business Plan
    - Create an Effective Business Plan
7. Identify and Meet a Market Need
    - The Value of Market Research
    - How to Perform Market Research Entrepreneurship Syllabus
    - Identify Your Competition
8. Finance, Protect, and Insure Your Business
    - Put Together a Financial Plan
    - Obtain Financing for Your Business
    - Protect Your Business
9. Choose Your Location & Set Up for Business
    - Choose a Retail Business Location
    - Choose a Location for a Nonretail Business
    - Obtain Space and Design the Physical Layout
    - Purchase Equipment, Supplies, and Inventory
10. Market Your Business
    - The Marketing Mix
    - Product, Price, Distribution, Price, and Promotion
    - Set Marketing Goals
11. Hire and Manage a Staff
    - Hire Employees
    - Create a Compensation Package
    - Manage your Staff
12. Record–Keeping and Accounting
    - Set up a Record Keeping System
    - Understand Basic Accounting
    - Track Your Inventory
13. Financial Management
    - Manage your Cash Flow

- Analyze Your Financial Performance
- Hire Experts

14. Use Technology
    - Technology and Your Business
    - Learn about the Interest
    - Purchase Technology
15. Intellectual property Rights
    - Patents
    - Copyright
    - Industrial design rights
    - Trademarks
    - Trade secrets
16. Innovation Contest
    - Innovative Idea
    - Proof of Concept (PoC)
    - Prototype Creation

The students may be grouped into 2 to 3

**TOTAL: 15 PERIODS**

**Outcomes**

At the end of the course, students can

- Identify personal strengths and value systems.
- Recall important tenets of digital literacy.
- Discuss the essentials of matters pertaining to money.
- Prepare for employment and self-employment.
- Illustrate the basics of entrepreneurship and identify new business opportunities.

**19MDC401** **VALUE ADDED COURSE – I** **L T P C**

**(PC HARDWARE AND TROUBLESHOOTING)** **- - - -**

## OBJECTIVES

The main objective of the course is to,

- Explore the various hardware components on a computer.
- Know about graphics card and types of CPU.
- Enhance the knowledge in system diagnostics.
- Exploit the problem solving techniques.
- Learn the ways of assembling the PC.

## COURSE CONTENTS

1. Installation of Hardware Components and Identifying the Memory
2. Installing Graphics cards, USB and Configuring it for better performance
3. Virtual Memory Configuration
4. Registry Cleaner, Spyware Detector and Diagnosing Hardware failures
5. Configuring BIOS
6. Troubleshooting and Isolating Computer Problems
7. Working with Motherboard and CPU
8. Assembling Motherboard
9. Fault detection after assembling

## OUTCOMES

Upon completion of the course, students will be able to,

- Explore the various hardware components on a computer.
- Know the graphics card usage and types of CPU.
- Enhance the knowledge in system diagnostics.
- Exploit the problem solving techniques.
- Learn the ways of assembling the PC.

**19ADT501** **DEEP LEARNING** **L T P C**

**3 1 0 4**

**OBJECTIVES**

- To understand and need and principles of deep neural networks
- To understand CNN and RNN architectures of deep neural networks
- To comprehend advanced deep learning models
- To learn the evaluation metrics for deep learning models
- To learn the basics of Data science in Deep learning

**UNIT I FUNDAMENTALS OF DEEP NETWORKS 9**

Linear Algebra: Scalars -- Vectors -- Matrices and tensors; Probability Distributions -- Gradient- based Optimization – Machine Learning Basics: Capacity -- Overfitting and underfitting -- Hyperparameters and validation sets -- Estimators -- Bias and variance -- Stochastic gradient descent -- Challenges motivating deep learning; Deep Networks: Deep feedforward networks; Regularization -- Optimization**.**

**UNIT II CONVOLUTIONAL NEURAL NETWORKS 9**

Convolution Operation -- Sparse Interactions -- Parameter Sharing -- Equivariance -- Pooling -- Convolution Variants: Strided - Tiled -- Transposed and dilated convolutions; CNN Learning: Nonlinearity Functions - Loss Functions - Regularization -- Optimizers --Gradient Computation**.**

**UNIT III RECURRENT NEURAL NETWORKS 10**

Unfolding Graphs - RNN Design Patterns: Acceptor - Encoder -Transducer; Gradient Computation - Sequence Modeling Conditioned on Contexts -Bidirectional RNN - Sequence to Sequence RNN – Deep Recurrent Networks - Recursive Neural Networks - Long Term Dependencies; Leaky Units: Skip connections and dropouts; Gated Architecture: LSTM.

**UNIT IV MODEL EVALUATION 8**

Performance metrics - Baseline Models - Hyperparameters: Manual Hyperparameter - Automatic Hyperparameter - Grid search - Random search - Debugging strategies.

**UNIT V AUTOENCODERS AND GENERATIVE MODELS 9**

Autoencoders: Undercomplete autoencoders -- Regularized autoencoders -- Stochastic encoders and

decoders -- Learning with autoencoders; Deep Generative Models: Variational autoencoders – Generative adversarial networks.

**TOTAL: 45 PERIODS**

**OUTCOMES**

After the completion of this course, students will be able to:

- Explain the basics in deep neural networks
- Apply Convolution Neural Network for image processing
- Apply Recurrent Neural Network and its variants for text analysis
- Apply model evaluation for various applications
- Apply auto encoders and generative models for suitable applications

**TEXT BOOK**

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, ``Deep Learning", MIT Press, 2016.
2. Andrew Glassner, “Deep Learning: A Visual Approach”, No Starch Press, 2021.

**REFERENCES**

1. Salman Khan, Hossein Rahmani, Syed Afaq Ali Shah, Mohammed Bennamoun, ``A Guide to Convolutional Neural Networks for Computer Vision", Synthesis Lectures on Computer Vision, Morgan & Claypool publishers, 2018.
2. Yoav Goldberg, ``Neural Network Methods for Natural Language Processing", Synthesis Lectures on Human Language Technologies, Morgan & Claypool publishers, 2017.

**E-RESOURCES**

1. https://nptel.ac.in/courses/106/105/106105152/ (Different Types of Learning)
2. https://nptel.ac.in/courses/106/106/106106202/ (Learning Problem)

**19ADT502** **BUSINESS INTELLIGENCE** **L T P C**

**3 1 0 4**

**OBJECTIVES**

The students will be able to

- To understand the Analytics Life Cycle.
- To comprehend the process of acquiring Business Intelligence
- To understand various types of analytics for Business Forecasting
- To model the supply chain management for Analytics.
- To apply analytics for different functions of a business

**UNIT I INTRODUCTION TO BUSINESS ANALYTICS** **9**

Analytics and Data Science – Analytics Life Cycle – Types of Analytics – Business Problem Definition – Data Collection – Data Preparation – Hypothesis Generation – Modeling – Validation and Evaluation – Interpretation – Deployment and Iteration

**UNIT II BUSINESS INTELLIGENCE** **9**

Data Warehouses and Data Mart - Knowledge Management – Types of Decisions - Decision Making Process - Decision Support Systems – Business Intelligence – OLAP –, Analytic functions

**UNIT III BUSINESS FORECASTING** **9**

Introduction to Business Forecasting and Predictive analytics - Logic and Data Driven Models – Data Mining and Predictive Analysis Modeling – Machine Learning for Predictive analytics.

**UNIT IV HR & SUPPLY CHAIN ANALYTICS** **9**

Human Resources – Planning and Recruitment – Training and Development - Supply chain network - Planning Demand, Inventory and Supply – Logistics – Analytics applications in HR & Supply Chain

**UNIT V MARKETING & SALES ANALYTICS** **9**

Marketing Strategy, Marketing Mix, Customer Behavior – selling Process – Sales Planning – Analytics applications in Marketing and Sales

**TOTAL: 45 PERIODS**

**OUTCOMES**

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

- Explain the real world business problems and model with analytical solutions
- Identify the business processes for extracting Business Intelligence
- Apply predictive analytics for business fore-casting
- Apply analytics for supply chain and logistics management
- Use analytics for marketing and sales

**TEXT BOOKS**

1. R. Evans James, Business Analytics, 2017
2. R N Prasad, Seema Acharya, Fundamentals of Business Analytics, 2016

**REFERENCES**

1. Philip Kotler and Kevin Keller, Marketing Management, 15th edition, PHI, 2016
2. VSP RAO, Human Resource Management, 3rd Edition, Excel Books, 2010.
3. Mahadevan B, "Operations Management -Theory and Practice",3rd Edition, Pearson Education, 2018.

**E-RESOURCES**

1. https://nptel.ac.in/courses/110105089 (Introduction)
2. https://archive.nptel.ac.in/courses/110/105/110105089/ (Descriptive Analytics , Inferential Analytics, Predictive Analytics, Prescriptive Analytics, Decision Analytics)

**19CSPX26** **OPTIMIZATION TECHNIQUES** **L T P C**

**3 0 0 3**

**OBJECTIVES**

The students will be able to

- Learn designing of a problem.
- Understand the linear programming problem with approximate solutions.
- Optimize these mathematical problems using nature based algorithms.
- Learn dynamic programming and quadratic approximation to electrical and electronic problems and applications.
- Find the appropriate technique to solve Game problem.

**UNIT I ENGINEERING APPLICATION OF OPTIMIZATION 9**

Engineering application of optimization-formulation of design problems as mathematical programming problems.

**UNIT II GENERAL STRUCTURE OF OPTIMIZATION 9**

General Structure of Optimization Algorithms-Constraints-The Feasible Region.

**UNIT III BRANCHES OF MATHEMATICAL PROGRAMMING 9**

Branches of Mathematical Programming: Optimization using calculus-Graphical Optimization-Linear Programming-Quadratic Programming-Integer Programming-Semi Definite Programming.

**UNIT IV OPTIMIZATION ALGORITHMS 9**

Optimization Algorithms like Genetic Optimization-Particle Swarm Optimization-Ant ColonyOptimization.

**UNIT V REAL LIFE PROBLEMS 9**

Real life Problems and their mathematical formulation as standard programming problems.

**TOTAL: 45 PERIODS**

**OUTCOMES**

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

- Make use of recursive algorithm design technique in appropriate contexts.
- Calculate and implement linked lists, stacks and queues in Python.

- Choose linear programming using Approximation and Randomized.
- Design flow-networks and matrix computation using strassen's algorithm.
- Describe the variable metric methods for constrained optimization.

**TEXT BOOKS**

1. Laurence A. Wolsey, "Integer Programming". Wiley. ISBN978-0-471-28366-9, 1998.
2. Andreas Antoniou, "Practical Optimization Algorithms and Engineering Applications", Springer, 2007.

**REFERENCES**

1. Dimitris Bertsimas, Robert Weismantel, "Optimization Over Integers", Dynamic Ideas. ISBN 978-0-9759146-2-5, 2005.
2. John K. Karlof, "Integer programming: theory and practice". CRC Press. ISBN 978-0-8493-1914-3, 2006.

**E-RESOURCES**

1. http://www.sctie.iitkgp.ernet.in/ (Introduction)
2. https://onlinecourses.nptel.ac.in/noc21_me10/preview ( Fundamentals)

**19CSE501** **COMPUTER NETWORKS** **L T P C**

**3 0 2 4**

**OBJECTIVES**

The main objective of the course is to

- Understand the protocol layering and physical level communication.
- Analyze the various data link protocols and media access.
- Learn the functions of network layer and the various routing protocols.
- Familiarize the protocols and congestion control of the Transport layer.
- Understand the functions of the application layer protocols.
- Apply the various algorithms to enhance the networking.

**UNIT I INTRODUCTION AND PHYSICAL LAYER 9**

Networks – Network Types – Protocol Layering – TCP/IP Protocol suite – OSI Model – Physical Layer: Performance – Transmission media – Switching – Circuit-switching – Packet Switching.

**UNIT II DATA-LINK LAYER & MEDIA ACCESS 9**

Introduction – Link-Layer Addressing – DLC Services – Data-Link Layer Protocols HDLC– PPP – Media Access Control – Wired LANs: Ethernet – Introduction to Wireless LANs – IEEE 802.11, Bluetooth – Connecting Devices.

**UNIT III NETWORK LAYER 9**

Network Layer Services – Packet switched networks – Performance – IPV4 Addresses – Forwarding of IP Packets – Network Layer Protocols: IP, ICMP v4 – Unicast Routing Algorithms – Protocols – Multicasting Basics – IPV6 Addressing – IPV6 Protocol.

**UNIT IV TRANSPORT LAYER 9**

Introduction – Transport Layer Protocols – Services – Port Numbers – User Datagram Protocol – Transmission Control Protocol – SCTP.– Congestion Control and Techniques.

**UNIT V APPLICATION LAYER 9**

WWW and HTTP – FTP – Email –Telnet – SSH – DNS – SNMP.

**LABORATORY PART**

**LIST OF EXPERIMENTS**

(Any Eight Experiments to be Conducted)

1. Learn to use commands like tcp dump, net stat, ifconfig, nslookup and traceroute. Capture ping and traceroute PDUs using a network protocol analyzer and examine.
2. Write a HTTP web client program to download a web page using TCP sockets.
3. Applications using TCP sockets like:
   a. Echo client and echo server
   b. Chat
   c. File Transfer
4. Write a program for congestion control using Leaky Bucket Algorithm.
5. Simulation of DNS using UDP sockets.
6. Write a code simulating ARP /RARP protocols.
7. Study of Network simulator (NS) and Simulation of Congestion Control Algorithms using NS.
8. Study of TCP/UDP performance using Simulation tool.
9. Simulation of Distance Vector/ Link State Routing algorithm.

**TOTAL : 45+15 = 60 PERIODS**

**OUTCOMES**

On Completion of the course, the students should be able to,

- Understand the basic layers and its functions in computer networks.
- Know the various data link protocols and media access.
- Analyze and design routing algorithms.
- Study the transport protocols and congestion control in transport layer.
- Understand the working of various application layer protocols.
- Apply the concepts and algorithms in networking applications.

**TEXT BOOKS**

1. Behrouz A Forouzan 'Data Communication and Networking', 4th Edition, Mcgraw Hill, 2016.
2. William Stallings, "Data and Computer Communications", 10th Edition, Pearson Education, 2013.

**REFERENCES**

1. Larry L. Peterson, Bruce S. Davie, Computer Networks: A Systems Approach, 5th Edition, Morgan Kaufmann Publishers Inc., 2012.
2. Nader F. Mir, Computer and Communication Networks, 2nd Edition, Prentice Hall, 2014.

**E – RESOURCES**

1. https://nptel.ac.in/courses/106/106/106106091/ (Introduction to Computer Networks)
2. https://nptel.ac.in/courses/106/105/106105082/ (Computer Networks)

**19ADE501** **DATA ANALYTICS** **L T P C**

**3 0 2 4**

**OBJECTIVES**

- To understand big data.
- To learn and use NoSQL big data management.
- To learn mapreduce analytics using Hadoop and related tools.
- To work with map reduce applications
- To understand the usage of Hadoop related tools for Big Data Analytics
- To understand the usage of Cassandra, Hadoop, Java, Pig, Hive and HBases software.

**UNIT I UNDERTANDING BIG DATA 5**

Introduction to big data – convergence of key trends – unstructured data – industry examples of big data – web analytics – big data applications– big data technologies – introduction to Hadoop – open source technologies – cloud and big data – mobile business intelligence – Crowd sourcing analytics – inter and trans firewall analytics.

**UNIT II NOSQL DATA MANAGEMENT 7**

Introduction to NoSQL – aggregate data models – key-value and document data models – relationships – graph databases – schemaless databases – materialized views – distribution models – master-slave replication – consistency - Cassandra – Cassandra data model – Cassandra examples – Cassandra clients.

**UNIT III MAP REDUCE APPLICATIONS 6**

MapReduce workflows – unit tests with MRUnit – test data and local tests – anatomy of MapReduce job run – classic Map-reduce – YARN – failures in classic Map-reduce and YARN – job scheduling – shuffle and sort – task execution – MapReduce types – input formats – output formats.

**UNIT IV BASICS OF HADOOP 6**

Data format – analyzing data with Hadoop – scaling out – Hadoop streaming – Hadoop pipes – design of Hadoop distributed file system (HDFS) – HDFS concepts – Java interface – data flow – Hadoop I/O – data integrity – compression – serialization – Avro – file-based data structures - Cassandra – Hadoop integration.

**UNIT V HADOOP RELATED TOOLS 6**

Hbase – data model and implementations – Hbase clients – Hbase examples – praxis. Pig – Grunt – pig data model – Pig Latin – developing and testing Pig Latin scripts.Hive – data types and file formats – HiveQL data definition – HiveQL data manipulation – HiveQL queries.

**TOTAL : 30+30 = 60 PERIODS**

**LABORATORY PART**

**LIST OF EXPERIMENTS**

(All Experiments to be conducted)

1. Downloading and installing Hadoop; Understanding different Hadoop modes. Startup scripts, Configuration files.
2. Hadoop Implementation of file management tasks, such as Adding files and directories, retrieving files and Deleting files
3. Implement of Matrix Multiplication with Hadoop Map Reduce
4. Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.
5. Installation of Hive along with practice examples.
6. Installation of HBase, Installing thrift along with Practice examples
7. Practice importing and exporting data from various databases**.**

**OUTCOMES**

After the completion of this course, students will be able to:

- Describe big data and use cases from selected business domains.
- Explain NoSQL big data management.
- Install, configure, and run Hadoop and HDFS.
- Perform map-reduce analytics using Hadoop.
- Use Hadoop-related tools such as HBase, Cassandra, Pig, and Hive for big data analytics.

**TEXT BOOKS**

1. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
2. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.
3. Sadalage, Pramod J. “NoSQL distilled”, 2013

**REFERENCES**

1. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
2. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
3. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010.

**E – RESOURCES**

1. https://nptel.ac.in/courses/110106072 (Introducation)
2. https://nptel.ac.in/courses/110106073(cloud and big data)

**19MGT501 ENGINEERING ECONOMICS AND MANAGEMENT L T P C**

**3 0 0 3**

**OBJECTIVES**

The main objective of the course is to,

- Understand the basics of Economics.
- Enable students to understand the fundamental economic concepts and value engineering.
- Enable the students to study the evolution of Management.
- Study the functions and principles of management.
- Learn the application of the principles in an organization.

**UNIT I INTRODUCTION TO ECONOMICS 9**

Introduction to Economics – Flow in an economy, Law of supply and demand, Concept of Engineering Economics – Engineering efficiency, Economic efficiency, Scope of engineering economics – Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost.

**UNIT II VALUE ENGINEERING 9**

Break-even analysis – P/ V ratio, Elementary economic Analysis – Material selection for product – Design selection for a product, Process planning – Make or buy decision, Value engineering – Function, aims, Value engineering procedure.

**UNIT III INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS 9**

Definition of Management – Science or Art – Manager Vs Entrepreneur – types of managers – managerial roles and skills – Evolution of Management – Scientific, human relations , system and contingency approaches – Types of Business organization – Sole proprietorship, partnership, company – public and private sector enterprises – Organization culture and Environment – Current trends and issues in Management.

**UNIT IV PLANNING AND ORGANISING 9**

Nature and purpose of planning – planning process – types of planning – Planning premises – Strategic Management – Decision making steps and process – Nature and purpose of organization – Formal and informal organization – organization chart – organization structure – centralization and decentralization –

HR Planning, Recruitment, **selection.**

**UNIT V DIRECTING AND CONTROLLING** **9**

Motivation – motivation theories – motivational techniques – leadership – types – communication – process of communication – barrier in communication – communication and IT – System and process of controlling – use of computers and IT in Management control – direct and preventive control – reporting.

**TOTAL: 45 PERIODS**

**OUTCOMES**

At the end of the course, the student will be able to,

- Apply the basics of economics and cost analysis to engineering applications.
- Summarize the steps involved in decision making with economic feasibility.
- Upon completion of the course, students will be able to have clear understanding of managerial functions like planning, organizing, staffing, leading & controlling and have same basic knowledge on international aspect of management.
- Understand the planning process in the organization.
- Understand the concept of organization, directing and controlling.

**TEXT BOOKS**

1. Panneer Selvam, R, "Engineering Economics", Prentice Hall of India Ltd, New Delhi, 2nd Edition, 2013.
2. Stephen P. Robbins & Mary Coulter, "Management", Prentice Hall (India)Pvt. Ltd., 14th Edition, 2019.

**REFERENCES**

1. Chan S.Park, "Contemporary Engineering Economics", Prentice Hall of India, 6th Edition, 2016.
2. Donald.G. Newman, Jerome.P.Lavelle, "Engineering Economics and analysis" Engg. Press, Texas, 2010.

**E – RESOURCES**

1. https://nptel.ac.in/courses/112/107/112107209/ (Engineering Economic Analysis)
2. https://nptel.ac.in/courses/110/105/110105146/ (Principles of Management)

**19EEC501** **QUANTITATIVE APTITUDE LEARNING** **L T P C**

(Common To All Branch) **0 2 0 0**

**OBJECTIVES**

The main objective of the course is to,

- Introduce the basics concepts and techniques of numbers, Highest common factor and Least common multiple.
- Develop the use of decimal fraction and problems on ages.
- Introduced basic concepts of time, work, distance, calender and clock.
- Acquaint the student with the concept of simple and compound interest.
- Produced the knowledge of polynomial and quadratic equations.

**UNIT I NUMBERS, HIGHEST COMMON FACTOR AND LEAST COMMON MULTIPLE 9**

Numbers and their basic classification – Types of number – Basic operations of numbers – Progression – Tests of divisibility – Highest common factor – Least common multiple.

**UNIT II DECIMAL FRACTION AND PROBLEMS BASED ON AGES 9**

Decimal fraction – Types of fraction – Comparison of fractions – Inserting fractions in between two given fractions – Relation between decimal fraction and normal fraction – Conversion of a decimal fraction into a vulgar fraction – Types of decimals – Conversion of mixed recurring decimal into a vulgar fraction – Standard form of decimal – Problems based on ages.

**UNIT III TIME, WORK, DISTANCE, CALENDER AND CLOCK 9**

General rule for time and work – General rule for work and wages – Speed – Unit of speed – Average speed – Some useful relations – Problems on Trains – Calenders and clocks – Odd days – Ordinary year – Leap year.

**UNIT IV SIMPLE INTEREST, COMPOUND INTEREST AND ELEMENTARY ALGEBRA 9**

Simple interest – Compound interest – Some useful relations – Difference between compound interest and simple interest – Short cut methods to solve special types of problems – Elementary Algebra and averages.

**UNIT V POLYNOMIAL AND QUADRATIC EQUATIONS 9**

Polynomial introduction – Degree of a polynomial – Types of polynomial – Operations on polynomial – Remainder and factor theorem – Quadratic equation – Pure Quadratic equation – Discriminant – Roots of the Quadratic equations – Solution of Quadratic equation – Framing of a Quadratic equation – Special types of roots.

**TOTAL: 45 PERIODS**

**OUTCOMES**

After successfully completing the course, the student will be able to,

- Use the basic concepts and techniques of the numbers, Highest common factor and Least common multiple.
- Apply the concept of decimal fraction and problems on ages.
- Apply the concept of time, work, distance, calender and clock.
- Acquire skills in simple interest, compound interest and elementary algebra.
- Be exposed to concepts and properties of polynomial and quadratic equations.

**TEXT BOOKS**

1. Aggarwal R.S., "Quantitative Aptitude", S.Chand & Company Ltd, New Delhi, 2012.
2. Dinesh Khattar, "Quantitative Aptitude for competitive examinations ", Pearson India Education Services Pvt. Ltd, New Delhi, 2019.

**REFERENCES**

1. Praveen R.V., "Quantitative Aptitude and Reasoning", PHI Learning Private Limited, Delhi, 2013.
2. Gupta P, "A unique Approach to Quantitative Aptitude ", Unique Publishers (I) Pvt. Ltd, New Delhi, 2017.

**E – RESOURCES**

1. https://youtube.com/playlist?list=RDQM5Xl256aOq24 (Time and Work)
2. https://youtu.be/KE7tQf9spPg (Aptitude)

**19MDC501** **VALUE ADDED COURSE – II** **LT P C**

**(WEB TECHNOLOGIES)** **- - - -**

(.NET/JAVASCRIPT/FIREBASE FRAMEWORK/ NODE JS WITH EXPRESS/ PHP)

Students shall undergo any one of the above said course

**OBJECTIVES**

The main objective of the course is, to enable the Students to,

- Learn the basic concepts in HTML, CSS, JavaScript.
- Understand the responsive design and development.
- Implement the trendy frameworks and establishment.
- Learn the web project management and maintenance process.
- Design a website with HTML5, JS, CSS3.
- Understand the real time hosting.

**COURSE CONTENTS**

1. Basic concepts of Web Technology and Internet Fundamentals.
2. Creation of CSS, Scripting and Interactive web pages.
3. Discussions on Server side and Client side programming, Web and application servers, Hypertext Preprocessor (PHP) and content management systems.
4. Learn the basics to advance level with different projects using frameworks.
5. Insight into Internet security, e–commerce, databases, social networking, mobile device Web design, and cloud computing.
6. Learn different frameworks with frontend and backend activities.
7. Understand the database connectivity.
8. Establish the real time hosting.
9. Learn to build a responsive website.

**OUTCOMES**

On Successful completion of the course the students will be able to

- Design Website using HTML5, CSS3 and JS.
- Design Responsive Sites.
- Manage, Maintain and Support Web Apps.
- Design Simple Applications using the web technologies.

- Maintain Database Connectivity.

**TEXT BOOKS**

1. Jon Duckett, "HTML and CSS: Design and Build Websites", John Wiley and Sons, 2014 Edition.
2. Uttam K. Roy, "Web Technologies" Oxford University Press, 13th impression, 2017.

**E – RESOURCES**

1. https://nptel.ac.in/courses/106/105/106105084/ (Introduction to Internets)
2. https://nptel.ac.in/courses/106/106/106106156/ (Modern Application Development)

## SEMESTER VI

**19ADT601 CRYPTANALYSIS AND NETWORK SECURITY L T P C**

**3 1 0 4**

**OBJECTIVES**

The main objective of the course is to,

- Learn about various encryption techniques.
- Understand the concept of Public key cryptography and number theory.
- Study about message authentication and hash functions.
- Impart knowledge on Network security and web security.
- Impart knowledge on System level security.
- Apply and analyze the various algorithms for encryption and decryption.

**UNIT I INTRODUCTION 9**

Security attacks, services and mechanisms – OSI Security Architecture – Classical Encryption Techniques – transposition techniques, steganography, Cipher Principles – Data Encryption Standard – Cipher Design Principles and Modes of Operation – Double DES – Triple DES – AES – Blowfish – RC5 algorithm.

**UNIT II NUMBER THEORY AND PUBLIC KEY CRYPTOGRAPHY 9**

Finite Fields and Number Theory – Groups, Rings, Fields – Modular arithmetic – Euclid's algorithm – Finite fields – Polynomial Arithmetic – Prime numbers – Fermat's and Euler's theorem – Testing for primality – The Chinese remainder theorem – Discrete logarithms – Key management – Diffie-hellman key exchange – Elliptic Curve Arithmetic and Cryptography – Key distribution – Public Key Cryptography and RSA.

**UNIT III AUTHENTICATION AND HASH FUNCTION 9**

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – MD5 – SHA – HMAC – CMAC – Authentication applications – Kerberos, X.509 – Digital signature and authentication protocols – DSS – El-Gamal – Schnorr.

**UNIT IV NETWORK SECURITY 9**

E-mail Security – Pretty Good Privacy – S/MIME – IP Security – Web Security**.**

**UNIT V SYSTEM LEVEL SECURITY 9**

Intrusion Detection System – Virus and related threats – Counter measures – Firewalls and types – design principles – Practical implementation of cryptography and security.

**TOTAL: 45 PERIODS**

**OUTCOMES**

Upon completion of the course, the students will be able to,

- Understand the concept of classical and modern encryption techniques.
- Explore the concept of public key cryptography by understanding various concept of number theory.
- Recognize the various authentication and hash functions.
- Analyze the E-mail, Web and IP Security principles.
- Managing the intrusion detection, attacks of viruses by applying the principles of firewalls and performing the practical implementation of cryptography and network security.
- Apply and analyze the various algorithms for encryption and decryption.

**TEXT BOOKS**

1. William Stallings, "Cryptography And Network Security – Principles and Practices", Pearson, 7th Edition, 2016.
2. Bruce Schneier," Applied Cryptography" John Wiley & Sons Inc. 2nd Edition,1996.

**REFERENCES**

1. Behrouz A.Foruzan, Cryptography and Network Security, Tata McGraw Hill, 2007.
2. Niels Ferguson, "Cryptography Engineering:Design Principles and Practical Applications", Wiley, 1st Edition, 2010.

**E – RESOURCES**

1. https://nptel.ac.in/courses/106/105/106105162/ (Introduction to Cryptography)
2. https://nptel.ac.in/courses/106/105/106105031/ (Overview on Modern Cryptography)

**19CSPX08 NATURAL LANGUAGE PROCESSING L T P C**

**3 0 0 3**

**OBJECTIVES**

The main objective of the course is to,

- Learn the basics of natural Language processing.
- Introduce the fundamental concepts and techniques of Natural language Processing for analyzing words based on Morphology.
- Understand the use of language models in NLP.
- Identify the approaches to syntax and semantics in NLP.
- Acquaint algorithmic description of the main language levels that includes morphology, syntax, and semantics for machine translation applications.

**UNIT I INTRODUCTION 9**

Introduction to various levels of natural language processing – Ambiguities and computational challenges in processing various natural languages – Introduction to Real life applications of NLP such as spell and grammar checkers, information extraction, question answering, and machine translation.

**UNIT II TEXT PROCESSING AND MOROPOLOGY 9**

Character Encoding – Word Segmentation – Sentence Segmentation – Introduction to Corpora, Corpora Analysis – Inflectional and Derivation Morphology – Morphological Analysis and Generation using finite state transducers.

**UNIT III LEXICAL SYNTAX AND LANGUAGE MODELING 9**

Introduction to Word Types – POS Tagging – Maximum Entropy Models for POS tagging – Multi–Word Expressions – The Role of Language Models – Simple N-gram Models – Estimating Parameters and Smoothing – Evaluating Language Models.

**UNIT IV SYNTAX AND SEMANTICS 9**

Introduction to Phrases – Clauses and Sentence Structure – Shallow Parsing and Chunking – Shallow Parsing with Conditional Random Fields (CRF) – Lexical Semantics – Word Sense Disambiguation – WordNet – Thematic Roles – Semantic Role Labelling with CRFs.

**UNIT V APPLICATIONS OF NLP** **9**

NL Interfaces – Text Summarization – Sentiment Analysis – Machine Translation – Question answering – Recent Trends in NLP.

**TOTAL: 45 PERIODS**

**OUTCOMES**

Upon completion of the course, the students will be able to,

- Understand the principles and Process the Human Languages Such as English and other Indian Languages using computers.
- Demonstrate understanding of algorithms and techniques for text-based processing of natural language with respect to morphology.
- Perform POS tagging for a given natural language.
- Check the syntactic and semantic correctness of sentences using grammars and labeling.
- Develop computational methods for real world applications.

**TEXT BOOKS**

1. Daniel Jurafsky and James H. Martin "Speech and Language Processing", 3rd Edition, Prentice Hall, 2009.
2. NitinIndurkhya, Fred J. Damerau, "Handbook of Natural Language Processing", 2nd Edition, CRC Press, 2010.

**REFERENCES**

1. James Allen, "Natural Language Understanding", Pearson Publication, 8th Edition, 2012.
2. Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.

**E – RESOURCES**

1. https://nptel.ac.in/courses/106/105/106105158.html (Text Processing)
2. https://nptel.ac.in/courses/106/101/106101007.html (Part of Speech Tagging)

**19ADE601 IOT AND ITS APPLICATIONS L T P C**

**3 0 2 4**

**OBJECTIVES**

The main objective of the course is to,

- Understand Smart Objects and IoT Architectures.
- Learn about various IoT – related protocols.
- Build simple IoT Systems using Arduino and Raspberry Pi.
- Understand data analytics and cloud in the context of IoT.
- Develop IoT infrastructure for popular applications.
- Understand implementation of IOT application using Raspberry PI

**UNIT I FUNDAMENTALS OF IoT 9**

Evolution of Internet of Things – Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models – Simplified IoT Architecture and Core IoT Functional Stack – Fog, Edge and Cloud in IoT – Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects**.**

**UNIT II IoT PROTOCOLS 9**

IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT.

**UNIT III DESIGN AND DEVELOPMENT 9**

Design Methodology – Embedded computing logic – Microcontroller, System on Chips – IoT system building blocks – Arduino – Board details, IDE programming – Raspberry Pi – Interfaces and Raspberry Pi with Python Programming.

**UNIT IV DATA ANALYTICS AND SUPPORTING SERVICES 9**

Structured Vs Unstructured Data and Data in Motion Vs Data in Rest – Role of Machine Learning – No SQL Databases – Hadoop Ecosystem – Apache Kafka, Apache Spark – Edge Streaming Analytics and

Network Analytics – Xively Cloud for IoT, Python Web Application Framework – Django – AWS for IoT – System Management with NETCONF – YANG.

**UNIT V CASE STUDIES/INDUSTRIAL APPLICATIONS 9**

Cisco IoT system – IBM Watson IoT platform – Manufacturing – Converged Plant wide Ethernet Model (CPwE) – Power Utility Industry – Grid Blocks Reference Model – Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control**.**

**LABORATORY PART**

**LAB EXPERIMENT**

1. Sense the Available Networks Using Arduino
2. Measure the Distance Using Ultrasonic Sensor and Make Led Blink using Ardunio
3. Detect the Vibration of an Object Using Arduino
4. Connect with the Available Wi-Fi Using Arduino
5. Sense a Finger When it is Placed on Board Using Arduino
6. Temperature Notification Using Arduino
7. LDR to Vary the Light Intensity of LED Using Arduino
8. MySQL Database Installation in Raspberry Pi
9. SQL Queries by Fetching Data from Database in Raspberry Pi
10. Switch light on and off based on the user using Raspberry Pi

**TOTAL : 45 + 15 = 60 PERIODS**

**OUTCOMES**

Upon completion of the course, the student should be able to,

- Understand the concept of IoT.
- Analyze various protocols for IoT.
- Design a PoC of an IoT system using Rasperry PI/Arduino.
- Apply data analytics and use cloud offerings related to IoT.
- Analyze applications of IoT in real time scenario.

**TEXT BOOKS**

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things", Cisco Press, 2017.

2. ArshdeepBahga, Vijay Madisetti,"Internet of Things – A hands–on approach", Universities Press, 2015.

**REFERENCES**

1. Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Key applications and Protocols", Wiley, 2012 .
2. Jan Ho¨ ller, VlasiosTsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand. David Boyle,"From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence", Elsevier, 2014.

**E–RESOURCES**

1. https://nptel.ac.in/courses/106/105/106105166/ ( Introduction to IoT)
2. https://nptel.ac.in/courses/108/108/108108098/ ( IoT Protocols)

**19ADE602 DATA VISUALIZATION L T P C**

**3 0 2 4**

**OBJECTIVES**

- To outline an overview of exploratory data analysis.
- To implement data visualization using Matplotlib.
- To perform univariate data exploration and analysis.
- To apply bivariate data exploration and analysis.
- To use Data exploration and visualization techniques for multivariate and time series data.
- To understand Data Analysis and Visualization tools

**UNIT I EXPLORATORY DATA ANALYSIS 9**

EDA fundamentals – Understanding data science – Significance of EDA – Making sense of data – Comparing EDA with classical and Bayesian analysis – Software tools for EDA - Visual Aids for EDA- Data transformation techniques-merging database, reshaping and pivoting, Transformation techniques - Grouping Datasets - data aggregation – Pivot tables and cross-tabulations.

**UNIT II VISUALIZING USING MATPLOTLIB 9**

Importing Matplotlib – Simple line plots – Simple scatter plots – visualizing errors – density and contour plots – Histograms – legends – colors – subplots – text and annotation – customization – three dimensional plotting - Geographic Data with Basemap - Visualization with Seaborn.

**UNIT III UNIVARIATE ANALYSIS 9**

Introduction to Single variable: Distributions and Variables - Numerical Summaries of Level and Spread - Scaling and Standardizing – Inequality - Smoothing Time Series.

**UNIT IV BIVARIATE ANALYSIS 9**

Relationships between Two Variables - Percentage Tables - Analyzing Contingency Tables - Handling Several Batches - Scatter plots and Resistant Lines – Transformations.

**UNIT V MULTIVARIATE AND TIME SERIES ANALYSIS 9**

Introducing a Third Variable - Causal Explanations - Three-Variable Contingency Tables and Beyond - Longitudinal Data – Fundamentals of TSA – Characteristics of time series data – Data Cleaning – Time-based indexing – Visualizing – Grouping – Resampling.

**LABORATORY PART**

**LIST OF EXPERIMENTS**

(All Experiments to be conducted)

1. Install the data Analysis and Visualization tool: R/ Python /Tableau Public/ Power BI
2. Perform exploratory data analysis (EDA) on with datasets like email data set. Export all your emails as a dataset, import them inside a pandas data frame, visualize them and get different insights from the data.
3. Working with Numpy arrays, Pandas data frames , Basic plots using Matplotlib.
4. Explore various variable and row filters in R for cleaning data. Apply various plot features in R on sample data sets and visualize.
5. Perform Time Series Analysis and apply the various visualization techniques.
6. Perform Data Analysis and representation on a Map using various Map data sets with Mouse Rollover effect, user interaction, etc..
7. Build cartographic visualization for multiple datasets involving various countries of the world; states and districts in India etc.
8. Perform EDA on Wine Quality Data Set

.

**OUTCOMES**

- At the end of this course, the students will be able to:
- Understand the fundamentals of exploratory data analysis.
- Implement the data visualization using Matplotlib.
- Perform univariate data exploration and analysis.
- Apply bivariate data exploration and analysis.
- Use Data exploration and visualization techniques for multivariate and time series data.

**TOTAL: 60+15=75 PERIODS**

**TEXT BOOKS**

1. Suresh Kumar Mukhiya, Usman Ahmed, "Hands-On Exploratory Data Analysis with Python", Packt Publishing, 2020. (Unit 1)
2. Jake Vander Plas, "Python Data Science Handbook: Essential Tools for Working with Data", Oreilly, 1st Edition, 2016. (Unit 2)

## REFERENCES

1. Eric Pimpler, Data Visualization and Exploration with R, GeoSpatial Training service, 2017.
2. Claus O. Wilke, "Fundamentals of Data Visualization", O'reilly publications, 2019.

## E–RESOURCES

1. https://nptel.ac.in/courses/127101012(Introducation)
2. https://elearn.nptel.ac.in/shop/iit-workshops/completed/data-visualization-with-r/(r languange)

**19ADJ601** **MINI PROJECT** **L T P C**

**0 0 2 1**

**OBJECTIVES**

The main objective of this course is to,

- Identify a specific problem for the current need of the society and collecting information related to the same through detailed review of articles.
- Develop the skills to formulate a technical project.
- Utilize new tools,algorithms and mechanisms that contribute to obtain the solution.
- Test and validate the results obtained through conformance.
- Prepare project reports and to face reviews and viva-voce examination.

**GUIDELINES**

The students in a group of 3 to 4 works on a topic approved by the Head of the Department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor.The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester.The project work is evaluated based on oral presentation and the project report jointly by the Project Coordinator and internal examiner constituted by the Head of the Department.

**TOTAL: 30 PERIODS**

**OUTCOMES**

On Completion of the project work students will be able to,

- Identify a specific problem for the current need of the society and collecting information related to the same through detailed review of articles.
- Develop the skills to formulate a technical project.
- Test and validate the results obtained through conformance.
- Prepare project reports and to face reviews and viva voce examination.
- Take up any challenging practical problems and find the solution by formulating proper methodology.

**19MDC601** **CONSTITUTION OF INDIA** **L T P C**

( Common to ALL BRANCH) **3 0 0 0**

**OBJECTIVES**

The main objective of this course is to,

- Understand the Meaning of the constitution law and constitutionalism.
- Realize the fundamental rights.
- Understand the execution powers of union and states.
- Be aware of the Constitutional powers.
- acquaint with other Constitutional Functionaries.

**UNIT I INTRODUCTION**

Meaning of the constitution law and constitutionalism – Historical perspective of the Constitution of India – Preamble – Salient features and characteristics of the Constitution of India – Citizenship.

**UNIT II FUNDAMENTAL RIGHTS**

Scheme of the fundamental rights – The scheme of the Fundamental Duties and its legal status – The Directive Principles of State Policy – Its importance and implementation.

**UNIT III UNION AND STATE EXECUTIVE**

Federal structure and distribution of legislative and financial powers between the Union and the States – Parliamentary Form of Government in India – The constitution powers and status of the President of India – Governor – Appointment, Powers and Functions.

**UNIT IV CONSTITUTIONAL POWERS**

Amendment of the Constitutional Powers and Procedure – The historical perspectives of the constitutional amendments in India – Emergency Provisions : National Emergency, President Rule, Financial Emergency.

**UNIT V OTHER CONSTITUIONAL FUNCTIONARIES**

Election Commission of India: Organization, Powers and Functions, Union Public Service Commission, State Public Service Commission – Local Self Government.

**OUTCOMES**

At the end of the course, the students will be able to,

- Understand the Salient features and characteristics of the Constitution of India.
- Analyze the scheme of the Fundamental rights and Duties.
- Evaluate in detail the powers between the Union and the States.
- Know the concept of Constitutional Powers.
- Recognize other constitutional functionaries.

**TEXT BOOKS**

1. Durga Das Basu, "Introduction to the Constitution of India**"**,24th Edition,Lexis Nexis Publishers,2019**.**
2. Subhash by C. Kashyap**,"** Our Constitution",National Book Trust,2019.

**REFERENCES**

1. M.Laxmikanth,"Indian Polity", 5th Edition, Spectrum Publishers,2016.
2. Granville Austin, "The Indian Constitution: Cornerstone of a Nation", Classic Reissue,Oxford India Publishers,1999.

**E – RESOURCES**

1. https://www.youtube.com/watch?v=vq2Q1_v6TNU (Constitution)
2. https://www.india.gov.in/my–government/constitution–india/constitution–india–full–text (Fundamental Rights)

**19ADE701 COMPUTER VISION L T P C**

**3 0 2 4**

**OBJECTIVES**

- To understand the fundamental concepts related to Image formation and processing.
- To learn feature detection, matching and detection
- To become familiar with feature based alignment and motion estimation
- To develop skills on 3D reconstruction
- To understand image based rendering and recognition
- To understand image segmentation using Graphcut

**UNIT I INTRODUCTION TO IMAGE FORMATION AND PROCESSING 6**

Computer Vision - Geometric primitives and transformations - Photometric image formation - The digital camera - Point operators - Linear filtering - More neighborhood operators - Fourier transforms - Pyramids and wavelets - Geometric transformations - Global optimization.

**UNIT II FEATURE DETECTION, MATCHING AND SEGMENTATION 6**

Points and patches - Edges - Lines - Segmentation - Active contours - Split and merge - Mean shift and mode finding - Normalized cuts - Graph cuts and energy-based methods**.**

**UNIT III FEATURE-BASED ALIGNMENT & MOTION ESTIMATION 6**

2D and 3D feature-based alignment - Pose estimation - Geometric intrinsic calibration - Triangulation - Two-frame structure from motion - Factorization - Bundle adjustment - Constrained structure and motion - Translational alignment - Parametric motion - Spline-based motion - Optical flow - Layered motion**.**

**UNIT IV 3D RECONSTRUCTION 6**

Shape from X - Active rangefinding - Surface representations - Point-based representations- Volumetric representations - Model-based reconstruction - Recoveri ng texture maps and albedosos.

**UNIT V IMAGE-BASED RENDERING AND RECOGNITION 6**

View interpolation Layered depth images - Light fields and Lumigraphs - Environment mattes - Video-based rendering-Object detection - Face recognition - Instance recognition - Category recognition - Context and scene understanding- Recognition databases and test sets.

**LABORATORY PART**

**LIST OF EXPERIMENTS**

(All Experiments to be conducted)

1. OpenCV Installation and working with Python
2. Basic Image Processing - loading images, Cropping, Resizing, Thresholding, Contour analysis, Bolb detection
3. Image Annotation – Drawing lines, text circle, rectangle, ellipse on images
4. Image Enhancement - Understanding Color spaces, color space conversion, Histogram equialization, Convolution, Image smoothing, Gradients, Edge Detection
5. Image Features and Image Alignment – Image transforms – Fourier, Hough, Extract ORB Image features, Feature matching, cloning, Feature matching based image alignment
6. Image segmentation using Graphcut / Grabcut
7. Camera Calibration with circular grid
8. Pose Estimation

**TOTAL :45+15= 60 PERIODS**

**OUTCOMES**

- To understand basic knowledge, theories and methods in image processing and computervision.
- To implement basic and some advanced image processing techniques in OpenCV
- To apply 2D a feature-based based image alignment, segmentation and motion estimations.
- To apply 3D image reconstruction techniques
- To design and develop innovative image processing and computer vision applications.
- To develop Image segmentation using Graphcut.

**TEXT BOOKS**

1. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer- Texts in Computer Science, Second Edition, 2022.
2. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, Second Edition, 2015.

**REFERENCES**

1. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.
2. Christopher M. Bishop; Pattern Recognition and Machine Learning, Springer, 2006

**E – RESOURCES**

1. https://onlinecourses.nptel.ac.in/noc19_cs58/preview(Imaging geometry).
2. https://nptel.ac.in/courses/108103174(introducation)

**19CSPX14 SOFTWARE PROJECT MANAGEMENT L T P C**

**3 0 0 3**

**OBJECTIVES**

The main objective of the course is to,

- Understand the Software Project Planning and Evaluation techniques.
- Plan and manage projects at each stage of the software development life cycle (SDLC).
- Learn about the activity planning and risk management principles.
- Manage software projects and control software deliverables.
- Develop skills to manage the various phases involved in project management and people management.

**UNIT I PROJECT EVALUATION AND PROJECT PLANNING 9**

Importance of Software Project Management – Activities – Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning.

**UNIT II PROJECT LIFE CYCLE AND EFFORT ESTIMATION 9**

Software process and Process Models – Choice of Process models – Rapid Application development – Agile methods – Dynamic System Development Method – Extreme Programming – Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points – COCOMO II-a Parametric Productivity Model.

**UNIT III ACTIVITY PLANNING AND RISK MANAGEMENT 9**

Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Formulating Network Model – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Risk Planning –Risk Management – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical paths – Cost schedules.

**UNIT IV PROJECT MANAGEMENT AND CONTROL 9**

Framework for Management and control – Collection of data – Visualizing progress – Cost monitoring – Earned Value Analysis – Prioritizing Monitoring – Project tracking – Change control – Software Configuration Management – Managing contracts – Contract Management.

**UNIT V STAFFING IN SOFTWARE PROJECTS** **9**

Managing people – Organizational behavior – Best methods of staff selection – Motivation – The Oldham-Hackman job characteristic model – Stress – Health and Safety – Ethical and Professional concerns – Working in teams – Decision making – Organizational structures – Dispersed and Virtual teams – Communications genres – Communication plans – Leadership.

**TOTAL: 45 PERIODS**

**OUTCOMES**

Upon completion of the course, the students will be able to,

- Understand Project Management principles while developing software.
- Gain extensive knowledge about the basic project management concepts, framework and the process models.
- Obtain adequate knowledge about software process models and software effort estimation techniques.
- Estimate the risks involved in various project activities.
- Define the checkpoints, project reporting structure, project progress and tracking mechanisms using project management principles.

**TEXT BOOKS**

1. Gopalaswamy Ramesh, "Managing Global Software Projects", McGraw Hill Education (India), 14th Reprint 2013.
2. Bob Hughes, Mike Cotterell and Rajib Mall: "Software Project Management", 5th Edition, Tata McGraw Hill, New Delhi, 2012.

**REFERENCES**

1. Robert K. Wysocki,"Effective Software Project Management", Wiley Publication, 2011.
2. Walker Royce,"Software Project Management", Addison–Wesley, 1998.

**E – RESOURCES**

1. https://nptel.ac.in/courses/106/105/106105218/ (Software Project Management–Standards)
2. https://nptel.ac.in/noc/courses/noc19/SEM2/noc19–cs70/ (Software Project Management)

**19CSE702** **CLOUD COMPUTING** **L T P C**

**3 0 2 4**

**OBJECTIVES**

The main objective of the course is to,

- Provide the overview of cloud computing.
- Understand the services provided by Cloud.
- Know the events maintaining inside the Cloud.
- Explain the concept of service oriented architecture.
- Describe some of the tools available for the creating Cloud.
- Apply and analyze the various tools for creating a cloud environment.

**UNIT I CLOUD FUNDAMENTALS** **9**

Defining cloud computing – cloud types – characteristics – assessing the role of open standards – measuring the cloud's value – computing total cost of ownership – specifying service level agreements – defining licensing models – understanding cloud architecture – cloud computing stack – connecting to the cloud.

**UNIT II CLOUD SERVICES** **9**

Defining IaaS – PaaS – SaaS – IdaaS – CaaS – Platforms – using virtualization techniques – load balancing and virtualization – understanding hypervisors – machine imaging – porting applications – capacity planning – exploring platform as a service.

**UNIT III CLOUD INFRASTRUCTURE AND MOBILE CLOUD** **9**

Managing the cloud – administering – cloud management products – emerging cloud management standards – understanding cloud security – securing the cloud – securing data – establishing identity and presence – working with mobile devices – mobile web services.

**UNIT IV SERVICES AND APPLICATIONS** **9**

Service oriented architecture – introduction – SOA communications – managing and monitoring – relation between SOA and cloud computing moving applications to the cloud – productivity software – using webmail services – communicating with the cloud – using media and streaming.

**UNIT V CASE STUDIES AND TOOLS** **9**

Amazon Web Services (AWS) – Google web services – Microsoft cloud services – cloudBees – creating and deploying real time application – Eucalyptus cloud.

**LABORATORY PART**

**LIST OF EXPERIMENTS**

1. Installation and Configuration of Hadoop.
2. Hadoop Implementation of file management tasks, such as Adding files and directories, Retrieving files and Deleting files.
3. Create an application (Ex: Word Count) using Hadoop Map/Reduce.
4. Implementation of Para-Virtualization using VM Ware's Workstation/ Oracle's Virtual Box and Guest O.S.
5. Installation of Google App Engine Launcher.
6. Create an application to run on compiler in virtualized OS.
7. Case Study: Amazon Web Services.
8. Develop a Guest Book Application using Google App Engine.

**TOTAL: 45+15 = 60 PERIODS**

**OUTCOMES**

Upon completion of the course, the students will be able to,

- Describe the concepts and technologies of big data analytics.
- Apply the techniques in storing, handling and analyzing big data.
- Discuss the concepts and terminologies of cloud computing.
- Demonstrate cloud frameworks and technologies.
- Describe and apply fine data intensive computing.
- Apply and analyze the various tools for creating a cloud environment.

**TEXT BOOKS**

1. Barrie Sosinsky, "Cloud Computing Bible", Wiley, 2011.
2. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi," Mastering Cloud Computing" McGraw Hill Education,2015.

**REFERENCES**

1. Anthony T.Velte, Toby J.Velte Robert Elsenpeter, "Cloud Computing: A Practical Approach", Tata McGraw – Hill Education Private Limited, New Delhi 2010.
2. Timothy Chou, "Introduction to Cloud Computing", Kindle Edition, 2010.

**E – RESOURCES**

1. https://onlinecourses.nptel.ac.in/noc20_cs20/preview (Cloud Computing)
2. https://nptel.ac.in/courses/106/105/106105223/ (Introduction to Cloud)

**19ADJ701** **PROJECT WORK (PHASE - I)** **L T P C**

**0 0 2 1**

**OBJECTIVES**

The main objective of the course is to,

- Identify a specific problem for the current need of the society and collecting information related to the same through detailed review of articles.
- Develop the skills to formulate a technical project.
- Analyze the problem statement with respect to the solutions.
- Design a methodology to resolve the identified problem.

**GUIDELINES**

The students in a group of 3 to 4 works on a topic approved by the Head of the Department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

**TOTAL: 30 PERIODS**

**OUTCOMES**

On Completion of the project work students will be able to,

- Identify a specific problem for the current need of the society and collecting information related to the same through detailed review of articles.
- Develop the skills to formulate a technical project.
- Analyze the problem statement with respect to the solutions.
- Design the methodology to resolve the identified problem.

**SEMESTER VIII**

| | | |
|---|---|---|
| **19ADJ801** | **PROJECT WORK(PHASE – II)** | **L T P C**<br>**0 0 20 10** |

**OBJECTIVES**

The main objective of the course is to,

- Develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
- Utilize new tools, algorithms and mechanisms that contribute to obtain the solution.
- Test and validate the results obtained through conformance.
- Prepare project report and to face reviews and viva voce examination.
- Develop the ability to take up the challenging practical problems.

**GUIDELINES**

The students in a group of 3 to 4 works on a topic approved by the Head of the Department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

**TOTAL: 300 PERIODS**

**OUTCOMES**

On Completion of the project work students will be able to,

- Develop the ability to solve a specific problem till the successful solution of the same.
- Utilize new tools, algorithms and mechanisms that contribute to obtain the solution.
- Test and validate the results obtained through conformance.
- Prepare project report and to face reviews and viva voce examination.
- Take up any challenging practical problems and find the solution by formulating proper methodology.

**PROFESSIONAL ELECTIVE - I**

| 19ADPX01 | R PROGRAMMING | L T P C |
|---|---|---|
| | | 3 0 0 3 |

**OBJECTIVES**

- To understand the basics in R programming in terms of constructs, control statements, string functions
- To learn to apply R programming for Text processing
- To understand the use of R Big Data analytics
- To able to appreciate and apply the R programming from a statistical perspective
- To understand auto correlation and clustering

**UNIT I INTRODUCING TO R** **9**

R DataStructures– Help functions in R –Vectors– Scalars– Declarations– recycling – Common Vector operations – Using all and any – Vectorized operations – NA and NU LL values – Filtering – Vectorised if-then else – Vector Equality – Vector Elementnames

**UNIT II MATRICES, ARRAYS AND LISTS** **9**

Creating matrices – Matrix operations – Applying Functions to Matrix Rows and Columns – Adding and deleting rows and columns – Vector/Matrix Distinction – Avoiding Dimension Reduction – Higher Dimensional arrays – lists – Creating lists – General list operations – Accessing list components and values – applying functions to lists – recursive lists

**UNIT III DATA FRAMES** **9**

Creating Data Frames – Matrix-like operations in frames – Merging Data Frames – Applying functions to Data frames – Factors and Tables – factors and levels – Common functions used with factors – Working with tables - Other factors and table related functions - Control statements – Arithmetic and Boolean operators and values – Default values for arguments - Returning Boolean values – functions are objects – Environment and Scope issues – Writing Upstairs - Recursion – Replacement functions – Tools for composing function code – Math and SimulationsinR

**UNIT IV OOP** **9**

S3 Classes – S4 Classes – Managing your objects – Input/Output – accessing keyboard and monitor

– reading and writing files – accessing the internet – String Manipulation – Graphics – Creating Graphs – Customizing Graphs – Saving graphs to files – Creating three dimensionalplots

**UNIT V INTERFACING** **9**

Interfacing R to other languages – Parallel R – Basic Statistics – Linear Model – Generalized Linear models – Non-linear models – Time Series and Auto-correlation – Clustering

**TOTAL:45 PERIODS**

**OUTCOMES**

At the end of this course, the students will be able to:

- Create artful graphs to visualize complex data sets and functions
- Write more efficient code using parallel R and vectorization
- Interface R with C/C++ and Python for increased speed or functionality
- Find new packages for text analysis, image manipulation
- Perform statistical analysis of the same

**TEXT BOOK**

1. Norman Matloff , "The Art of R Programming: A Tour of Statistical Software Design", No Starch Press, 2011
2. Jared P. Lander, "R for Everyone: Advanced Analytics and Graphics", Addison- Wesley Data & Analytics Series, 2013.

**REFERENCES**

1. Mark Gardener, " Beginning R – The Statistical Programming Language", Wiley, 2013
2. Robert Knell, "Introductory R: A Beginner's Guide to Data Visualisation, Statistical Analysis and Programming in R", Amazon Digital South Asia Services Inc, 2013.

**E – RESOURCES**

1. https://onlinecourses.nptel.ac.in/noc19_ma33/preview ( Introduction)
2. https://nptel.ac.in/courses/111104100 (Basics of calculations, functions, Matrices, Data Management, Format Functions, Data Frames, Statistical Functions)

**19ADPX02** **KNOWLEDGE ENGINEERING** **L T P C**

**3 0 0 3**

**OBJECTIVES**

- To understand the basics of Knowledge Engineering.
- To discuss methodologies and modeling for Agent Design and Development.
- To design and develop ontologies.
- To apply reasoning with ontologies and rules.
- To understand learning and rule learning.

**UNIT I REASONING UNDER UNCERTAINTY 6**

Introduction – Abductive reasoning – Probabilistic reasoning: Enumerative Probabilities – Subjective Bayesian view – Belief Functions – Baconian Probability – Fuzzy Probability – Uncertainty methods - Evidence-based reasoning – Intelligent Agent – Mixed-Initiative Reasoning Knowledge Engineering.

**UNIT II METHODOLOGY AND MODELING 6**

Conventional Design and Development – Development tools and Reusable Ontologies – Agent Design and Development using Learning Technology – Problem Solving through Analysis and Synthesis – Inquiry-driven Analysis and Synthesis – Evidence-based Assessment – Believability Assessment – Drill-Down Analysis, Assumption-based Reasoning, and What-If Scenarios.

**UNIT III ONTOLOGIES – DESIGN AND DEVELOPMENT 6**

Concepts and Instances – Generalization Hierarchies – Object Features – Defining Features – Representation – Transitivity – Inheritance – Concepts as Feature Values – Ontology Matching.

Design and Development Methodologies – Steps in Ontology Development – Domain Understanding and Concept Elicitation – Modelling-based Ontology Specification.

**UNIT IV REASONIING WITH ONTOLOGIES AND RULES 6**

Production System Architecture – Complex Ontology-based Concepts – Reduction and Synthesis rules and the Inference Engine – Evidence-based hypothesis analysis – Rule and Ontology Matching – Partially Learned Knowledge – Reasoning with Partially Learned Knowledge.

**UNIT V LEARNING AND RULE LEARNING 6**

Machine Learning – Concepts – Generalization and Specialization Rules – Types – Formal definition of Generalization. Modelling, Learning and Problem Solving – Rule learning and Refinement – Overview – Rule Generation and Analysis – Hypothesis Learning.

**TOTAL:45 PERIODS**

**OUTCOMES**

At the end of this course, the students will be able to:

- Understand the basics of Knowledge Engineering.
- Apply methodologies and modelling for Agent Design and Development.
- Design and develop ontologies.
- Apply reasoning with ontologies and rules.
- Understand learning and rule learning.

**TEXT BOOK**

1. Gheorghe Tecuci, Dorin Marcu, Mihai Boicu, David A. Schum, Knowledge Engineering Building Cognitive Assistants for Evidence-based Reasoning, Cambridge University Press, First Edition, 2016. (Unit 1 – Chapter 1 / Unit 2 – Chapter 3,4 / Unit 3 – Chapter 5, 6 / Unit 4 - 7 , Unit 5 – Chapter 8, 9 )
2. Ela Kumar, Knowledge Engineering, I K International Publisher House, 2018

**REFERENCES**

1. Ronald J. Brachman, Hector J. Levesque: Knowledge Representation and Reasoning, Morgan Kaufmann, 2004.
2. John F. Sowa: Knowledge Representation: Logical, Philosophical, and Computational Foundations, Brooks/Cole, Thomson Learning, 2000.

**E – RESOURCES**

1. https://onlinecourses.nptel.ac.in/noc19_mg33/preview( Introduction)
2. https://www.shiksha.com/online-courses/knowledge-management-by-nptel-iit-kharagpur-course-nptel7( Concept of knowledge-management)

**19ADPX03** **MICROPROCESSORAND MICROCONTROLLER** **L T P C**
**3 0 0 3**

**OBJECTIVES**

The main objective of the course is to,

- Understand the Architecture of 8086 microprocessor.
- Learn the design aspects of I/O and Memory Interfacing circuits.
- Interface microprocessors with supporting chips.
- Study the Architecture of 8051 microcontroller.
- Design a microcontroller - based system.
- Write Program to interface different I/O's with 8086 Processor and 8051 Microcontroller.

**UNIT I THE 8086 MICROPROCESSOR 9**

Introduction to 8086 – Microprocessor architecture – Addressing modes – Instruction set and assembler directives – Assembly language programming – Modular Programming – Linking and Relocation – Stacks – Procedures – Macros – Interrupts and interrupt service routines – Byte and String Manipulation.

**UNIT II 8086 SYSTEM BUS STRUCTURE 9**

8086 signals – Basic configurations – System bus timing – System design using 8086 – I/O programming – Introduction to Multiprogramming – System Bus Structure – Multiprocessor configurations – Coprocessor, Closely coupled and loosely Coupled configurations – Introduction to advanced processors.

**UNIT III I/O INTERFACING 9**

Memory Interfacing and I/O interfacing – Parallel communication interface – Serial communication interface – D/A and A/D Interface – Timer – Keyboard /display controller – Interrupt controller – DMA controller – Programming and applications Case studies: Traffic Light control, LED display , LCD display, Keyboard display interface and Alarm Controller.

**UNIT IV MICROCONTROLLER 9**

Architecture of 8051 – Special Function Registers(SFRs) – I/O Pins Ports and Circuits – Instruction set – Addressing modes – Assembly language programming.

**UNIT V INTERFACING MICROCONTROLLER 9**

Programming 8051 Timers – Serial Port Programming – Interrupts Programming – LCD & Keyboard Interfacing – ADC, DAC & Sensor Interfacing – External Memory Interface – Stepper Motor and Waveform generation – Comparison of Microprocessor, Microcontroller, PIC and ARM processors.

**TOTAL : 45 PERIODS**

**OUTCOMES**

At the end of the course, the students should be able to,

- Understand and execute programs based on 8086 microprocessor.
- Design Memory Interfacing circuits.
- Design and interface I/O circuits.
- Design and implement 8051 microcontroller based systems.
- Develop counters and Time delay circuits.
- Interface different I/O's with Processor and Controller.

**TEXT BOOKS**

1. Yu–Cheng Liu, Glenn A.Gibson,"Microcomputer Systems: The 8086 / 8088 Family –Architecture, Programming and Design", 2nd Edition, Prentice Hall of India, 2007. (UNIT I–III)
2. Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", 2nd Edition, Pearson education, 2011. (UNIT IV–V)

**REFERENCES**

1. Doughlas V.Hall,"Microprocessors and Interfacing, Programming and Hardware", TMH,2012.
2. A.K.Ray,K.M.Bhurchandi, "Advanced Microprocessors and Peripherals" 3rd Edition, Tata McGraw Hill, 2012.

**E – RESOURCES**

1. https://nptel.ac.in/courses/108/105/108105102/ (Microprocessors and Microcontrollers)
2. https://nptel.ac.in/courses/106/108/106108100/ (Microprocessors and Microcontrollers)

**19ADPX04** **MOBILE APPLICATIONS DEVELOPMENT** **L T P C**

**3 0 0 3**

**OBJECTIVES**

The main objective of the course is to,

- Understand system requirements for mobile applications.
- Generate suitable design using specific mobile development frameworks.
- Generate mobile application design.
- Implement the design using specific mobile development frameworks.
- Deploy the mobile applications in marketplace for distribution.

**UNIT I INTRODUCTION** **5**

Introduction to mobile applications – Embedded systems - Market and business drivers for mobile applications – Publishing and delivery of mobile applications – Requirements gathering and validation for mobile applications.

**UNIT II BASIC DESIGN** **8**

Introduction – Basics of embedded systems design – Embedded OS - Design constraints for mobile applications, both hardware and software related – Architecting mobile applications – User interfaces for mobile applications – touch events and gestures – Achieving quality constraints – performance, usability, security, availability and modifiability.

**UNIT III ADVANCED DESIGN** **8**

Designing applications with multimedia and web access capabilities – Integration with GPS and social media networking applications – Accessing applications hosted in a cloud computing environment – Design patterns for mobile applications.

**UNIT IV ANDROID** **12**

Introduction – Establishing the development environment – Android architecture – Activities and views – Interacting with UI – Persisting data using SQLite – Packaging and deployment – Interaction with server side applications – Using Google Maps, GPS and Wifi – Integration with social media applications.

**UNIT V IOS** **12**

Introduction to Objective C – iOS features – UI implementation – Touch frameworks – Data persistence using Core Data and SQLite – Location aware applications using Core Location and Map Kit – Integrating calendar and address book with social media application – Using Wifi - iPhone marketplace.

**TOTAL : 45 PERIODS**

**OUTCOMES**

Upon completion of the course, the students should be able to:

- Describe the requirements for mobile applications.
- Explain the challenges in mobile application design and development.
- Develop design for mobile applications for specific requirements.
- Implement the design using Android SDK.
- Implement the design using Objective C and iOS.

**TEXT BOOKS**

1. Charlie Collins, Michael Galpin and Matthias Kappler, "Android in Practice", DreamTech, 2012.
2. David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, "Beginning iOS 6 Development: Exploring the iOS SDK", Apress, 2013.

**REFERENCES**

1. Reto Meier, "Professional android Development", Wiley-India Edition, 2012.
2. James Dovey and Ash Furrow, "Beginning Objective C", Apress, 2012.

**E-RESOURCES**

1. https://nptel.ac.in/courses/106/106/106106156/ (Introduction to Modern Application Development)
2. https://nptel.ac.in/courses/106/106/106106222/ (Mobile Application Development)

**19CSPX16** **SEMANTIC WEB** **L T P C**

**3 0 0 3**

**OBJECTIVES**

To enable the students to,

- Understand the need of semantic web in web services**.**
- Know the methods to discover, classify and build ontology for more reasonable results in searching.
- Build and implement a small ontology.
- Build semantically descriptive of chosen problem domain.
- Implement applications that can access use and manipulate the ontology.

**UNIT I INTRODUCTION** **9**

Introduction to the Syntactic web and Semantic Web Evolution of the Web – The visual and syntactic web Levels of Semantics – Metadata for web information – The semantic web architecture and technologies Contrasting Semantic with Conventional Technologies Semantic Modeling – Potential of semantic web solutions and challenges of adoption.

**UNIT II ONTOLOGICAL ENGINEERING** **9**

Ontologies Taxonomies Topic Maps Classifying Ontologies Terminological aspects: concepts, terms, relations between them Complex Objects Subclasses and Sub-properties definitions Upper Ontologies Quality Uses – Types of terminological resources for ontology building Methods and methodologies for building ontologies Multilingual Ontologies – Ontology Development process and Life cycle Methods for Ontology Learning Ontology Evolution Versioning.

**UNIT III STRUCTURING AND DESCRIBING WEB RESOURCES** **9**

Structured Web Documents – XML Structuring Namespaces Addressing Querying Processing – RDF RDF Data Model Serialization Formats – RDF Vocabulary Inferencing – RDFS basic Idea Classes Properties – Utility Properties RDFS Modeling for Combinations and Patterns – Transitivity.

**UNIT IV WEB ONTOLOGY LANGUAGE** **9**

OWL Sub-Languages Basic Notions – Classes – Defining and Using Properties Domain and Range Describing Properties – Data Types Counting and Sets – Negative Property Assertions Advanced Class

Description Equivalence Owl Logic.

**UNIT V SEMANTIC WEB TOOLS AND APPLICATIONS 9**

Development Tools for Semantic Web Jena Framework SPARL Querying semantic web – Semantic Wikis – Semantic Web Services Modeling and aggregating social network data – Ontological representation of social relationships, Aggregating and reasoning with social network data.

**TOTAL: 45 PERIODS**

**OUTCOMES**

Upon completion of the course, the students will be able to,

- Understand semantic web basics, architecture and technologies.
- Represent data from a chosen problem in XML with appropriate semantic tags obtained or derived from the ontology.
- Understand the semantic relationships among these data elements using Resource Description Framework (RDF).
- Design and implement a web services application that discovers the data and/or other web services via the semantic web.
- Discover the capabilities and limitations of semantic web technology for social networks.

**TEXT BOOKS**

1. Liyang Yu, "A Developer's Guide to the Semantic Web" , Springer, 1st Edition, 2011.
2. Dean Allemang and James Hendler, "Semantic Web for the Working Ontologist: Effective Modeling in RDFS and OWL", MorganKaufmann ,2nd Edition,2011.

**REFERENCES**

1. Grigoris Antoniou, Frank van Harmelen, "A Semantic Web Primer", 2nd Edition (Cooperative Information Systems)(Hardcover), MIT Press, 2008.
2. Robert M. Colomb,"Ontology and the Semantic Web", Volume 156 Frontiers in Artificial Intelligence and Applications (Frontier in Artificial Intelligence and Applications), IOSPress, 2007.

**E – RESOURCES**

1. https://www.4shared.com/postDownload/PIlc9IXb/000semantic–web programming978.html (Introduction to Semiatic Web)
2. https://www.4shared.com/postDownload/P1irZQAU/semantic_web.html (Semantic Web)

**19CSPX23** **SOFT COMPUTING** **L T P C**

**3 0 0 3**

**OBJECTIVES**

To enable the students to,

- Learn the basic concepts of Soft Computing.
- Become familiar with various techniques like neural networks.
- Genetic algorithms and fuzzy systems.
- Apply soft computing techniques to solve problems.
- Understand the genetic representations.

**UNIT I INTRODUCTION TO SOFT COMPUTING 9**

Introduction – Artificial Intelligence – Artificial Neural Networks – Fuzzy Systems – Genetic Algorithm and Evolutionary Programming – Swarm Intelligent Systems – Classification of ANNs – McCulloch and Pitts Neuron Model – Learning Rules: Hebbian and Delta – Perceptron Network – Adaline Network – Madaline Network.

**UNIT II ARTIFICIAL NEURAL NETWORKS 9**

Introduction – Neuron, Nerve structure and synapse, Artificial Neuron and its model, activation functions, Neural network architecture: single layer and multilayer feed forward networks, recurrent networks, back propagation learning methods, effect of learning rule co-efficient ;back propagation algorithm, factors affecting backpropagation training, applications.

**UNIT III FUZZY SYSTEMS 9**

Basic concepts of fuzzy logic, Fuzzy sets and Crisp sets, Fuzzy set theory and operations, Properties of fuzzy sets, Fuzzy and Crisp relations, Fuzzy to Crisp conversion – Membership functions, interference, fuzzy if–then rules, Fuzzy implications and Fuzzy algorithms.

**UNIT IV GENETIC ALGORITHMS 9**

Basic concepts, working principle, procedures of GA, flow chart of GA, Genetic representations, (encoding) Initialization and selection, Genetic operators, Mutation, Generational Cycle, applications.

**UNIT V HYBRID SYSTEMS** **9**

Hybrid Systems – Neural Networks, Fuzzy Logic and Genetic – GA Based Weight Determination – LR-Type Fuzzy Numbers – Fuzzy Neuron – Fuzzy BP Architecture – Learning in Fuzzy BP – Inference by Fuzzy BP – Fuzzy ArtMap: A Brief Introduction – Soft Computing Tools – GA in Fuzzy Logic Controller Design – Fuzzy Logic Controller.

**TOTAL: 45 PERIODS**

**OUTCOMES**

Upon completion of this course, the students should be able to,

- Apply suitable soft computing techniques for various applications.
- Integrate various soft computing techniques for complex problems.
- Analyze and integrate various soft computing techniques.
- Solve problems effectively and efficiently.
- Parameterize various problems to be solved.

**TEXT BOOKS**

1. N.P.Padhy, S.P.Simon, "Soft Computing with MATLAB Programming" , Oxford University Press, 2015.
2. S.N.Sivanandam , S.N.Deepa, "Principles of Soft Computing", Wiley India Pvt. Ltd., 2nd Edition, 2011.

**REFERENCES**

1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, "Neuro - Fuzzy and Soft Computing", Prentice-Hall of India, 2002.
2. Kwang H.Lee, "First course on Fuzzy Theory and Applications", Springer, 2005.

**E – RESOURCES**

1. https://nptel.ac.in/courses/106/105/106105173/ (Introduction to Soft computing)
2. https://www.digimat.in/nptel/courses/video/106105173/L01.html (Computing Techniques)

**PROFESSIONAL ELECTIVE - II**

**19ADPX05** **CYBER SECURITY** **L T P C**

**3 0 0 3**

**OBJECTIVES**

- To learn cybercrime and cyber law.
- To understand the cyber attacks and tools for mitigating them.
- To understand information gathering.
- To learn how to detect a cyber attack.
- To learn how to prevent a cyber attack.

**UNIT I INTRODUCTION** **6**

Security – History of Internet – Impact of Internet – CIA Triad; Reason for Cyber Crime – Need for Cyber Security – History of Cyber Crime; Cybercriminals – Classification of Cybercrimes- A Global Perspective on Cyber Crimes; Cyber Laws – The Indian IT Act – Cybercrime and Punishment.

**UNIT II ATTACKS AND COUNTERMEASURES** **6**

OSWAP; Malicious Attack Threats and Vulnerabilities: Scope of Cyber-Attacks – Security Breach – Types of Malicious Attacks – Malicious Software – Common Attack Vectors – Social engineering Attack – Wireless Network Attack – Web Application Attack – Attack Tools – Countermeasures.

**UNIT III RECONNAISSANCE** **5**

Harvester – Whois – Netcraft – Host – Extracting Information from DNS – Extracting Information from E-mail Servers – Social Engineering Reconnaissance; Scanning – Port Scanning – Network Scanning and Vulnerability Scanning – Scanning Methodology – Ping Sweer Techniques – Nmap Command Switches – SYN – Stealth – XMAS – NULL – IDLE – FIN Scans – Banner Grabbing and OS Finger printing Techniques.

**UNIT IV INTRUSION DETECTION** **5**

Host -Based Intrusion Detection – Network -Based Intrusion Detection – Distributed or Hybrid Intrusion Detection – Intrusion Detection Exchange Format – Honeypots – Example System Snort.

**UNIT V INTRUSION PREVENTION 5**

Firewalls and Intrusion Prevention Systems: Need for Firewalls – Firewall Characteristics and Access Policy – Types of Firewalls – Firewall Basing – Firewall Location and Configurations – Intrusion Prevention Systems – Example Unified Threat Management Products.

**TOTAL : 30 PERIODS**

**OUTCOMES**

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

- Explain the basics of cyber security, cyber crime and cyber law
- Classify various types of attacks and learn the tools to launch the attacks
- Apply various tools to perform information gathering
- Apply intrusion techniques to detect intrusion
- Apply intrusion prevention techniques to prevent intrusion

**TEXTBOOKS**

1. Anand Shinde, "Introduction to Cyber Security Guide to the World of Cyber Security", Notion Press, 2021 (Unit 1)
2. Nina Godbole, Sunit Belapure, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley Publishers, 2011 (Unit 1)

**REFERENCES**

1. David Kim, Michael G. Solomon, "Fundamentals of Information Systems Security", Jones & Bartlett Learning Publishers, 2013 (Unit 2)
2. Patrick Engebretson, "The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made easy", Elsevier, 2011 (Unit 3)

**E – RESOURCES**

1. http://nptel.ac.in/courses/106105031/40(Intrusion prevention)
2. http://nptel.ac.in/courses/106105031/39( Introducation)

**19CSPX11** **GREEN COMPUTING** **L T P C**

**3 0 0 3**

**OBJECTIVES**

The main objective of the course is to,

- Learn the fundamentals of Green Computing.
- Analyze the Green computing Grid Framework.
- Understand the issues related with Green compliance.
- Study and develop various case studies.
- Understand the Business Strategies.

**UNIT I FUNDAMENTALS** **9**

Green IT Fundamentals: Business, IT, and the Environment – Green computing: carbon foot print, scoop on power – Green IT Strategies: Drivers, Dimensions, and Goals – Environmentally Responsible Business: Policies, Practices, and Metrics.

**UNIT II GREEN ASSETS AND MODELLING** **9**

Green Assets: Buildings, Data Centers, Networks, and Devices – Green Business Process Management: Modeling, Optimization, and Collaboration – Green Enterprise Architecture – Environmental Intelligence – Green Supply Chains – Green Information Systems: Design and Development Models.

**UNIT III GRID FRAMEWORK** **9**

Virtualization of IT systems – Role of electric utilities, Telecommuting, teleconferencing and teleporting – Materials recycling – Best ways for Green PC – Green Data center – Green Grid framework.

**UNIT IV GREEN COMPLIANCE** **9**

Socio-cultural aspects of Green IT – Green Enterprise Transformation Roadmap – Green Compliance: Protocols, Standards, and Audits – Emergent Carbon Issues: Technologies and Future.

**UNIT V CASE STUDIES** **9**

The Environmentally Responsible Business Strategies (ERBS) – Case Study Scenarios for Trial Runs – Case Studies – Applying Green IT Strategies and Applications to a Home, Hospital, Packaging Industry and Telecom Sector.

**TOTAL : 45 PERIODS**

**OUTCOMES**

On Completion of the course, the students should be able to,

- Acquire knowledge to adopt green computing practices to minimize negative impacts on the environment.
- Enhance the skill in energy saving practices in their use of hardware.
- Evaluate technology tools that can reduce paper waste and carbon footprint by the stakeholders.
- Understand the ways to minimize equipment disposal requirements.
- Understand the strategies in Business.

**TEXT BOOKS**

1. Bhuvan Unhelkar, "Green IT Strategies and Applications - Using Environmental Intelligence", CRC Press, June 2014.
2. Woody Leonhard, Katherine Murray, "Green Home computing for dummies", August 2012.

**REFERENCES**

1. Alin Gales, Michael Schaefer, Mike Ebbers, "Green Data Center: steps for the Journey", Shroff/IBM rebook, 2011.
2. John Lamb, "The Greening of IT", Pearson Education, 2009.

**E – RESOURCES**

1. https://www.learnpick.in/prime/documents/notes/details/2500/green–computing (Introduction)
2. https://www.studocu.com/row/document/gomal–university/green–computing/lecture–notes/green–computing–lecture–notes–1–4/6350932/view (Green Compliance)

**19CSPX12** **AGILE METHODOLOGY** **L T P C**

**3 0 0 3**

**OBJECTIVES**

The main objective of this course is to,

- Learn the basic concepts of Agile process.
- Provide students with a theoretical as well as practical understanding of agile software development practices and how small teams can apply them to create high-quality software.
- Provide a detailed requirements and an examination of Agile developments.
- Know the various process of knowledge evolution cycle.
- Understand Agile development and testing.

**UNIT I INTRODUCTION** **9**

Introduction: Software is new product development – Iterative and Evolutionary Methods – Agile – Agile Development – Case Study: Perform a comparative Study between Traditional / Heavy weight Methodologies with Agile Methodology and give the Key features and Limitations with some sample projects.

**UNIT II AGILE METHODOLOGY** **9**

Theories for Agile Management – Agile Software Development – Traditional Model vs. Agile Model – Classification of Agile Methods – Agile Manifesto and Principles – Agile Project Management – Agile Team Interactions – Ethics in Agile Teams – Agility in Design, Testing – Agile Documentations – Agile Drivers, Capabilities and Values

**UNIT III AGILE PRACTICES** **9**

Agile Project Management – Agile Environments – Agile Requirements – Case Study – Practices : At the end of each sprint, The team Should perform the : Report weekly deliveries of completed stories about the application to your customer. Consolidated Documents from Daily scrum, Demonstrations and Reviews. Perform reporting of automated and acceptance tests. Test driven development. Continuous Integration

**UNIT IV AGILITY AND KNOWLEDGE MANAGEMENT** **9**

Agile Information Systems – Agile Decision Making – Earl_S Schools of KM – Institutional Knowledge Evolution Cycle – Development, Acquisition, Refinement, Distribution, Deployment , Leveraging – KM in

Software Engineering – Managing Software Knowledge – Challenges of Migrating to Agile Methodologies – Agile Knowledge Sharing – Role of Story-Cards – Story-Card Maturity Model (SMM).

**UNIT V AGILITY AND QUALITY ASSURANCE 9**

Agile product development – Agile Metrics – Feature Driven Development (FDD) – Agile approach to Quality Assurance – Test Driven Development – Agile approach in Global Software Development

**TOTAL: 45 PERIODS**

**OUTCOMES**

Upon completion of the course, the students will be able to,

- Understand the basic concepts of Agile software process.
- Perform software iterative development process that how to plan and execute them.
- Apply various Agile methodologies to develop a software.
- Perform software process improvement as an outgoing task for development teams.
- Develop techniques and tools for improving team collaboration and software quality.

**TEXT BOOKS**

1. Craig Larman, "Agile and Iterative Development – A Manager's Guide", Pearson Education, 2006.
2. David J. Anderson, Eli Schragenheim, " Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results", Pearson Education,2003.

**REFERENCES**

1. Lisa Crispin,Janet Gregory, Mike Cohn,BrainMarick, "Agile Testing: A practical guide for Testers and Agile Teams", Addison–wesley publication, 2009.
2. Hazza and Dubinsky, "Agile Software Engineering, Series: Undergraduate Topics in Computer Science", Springer, 2009.

**E – RESOURCES**

1. https://nptel.ac.in/courses/110/104/110104073 (Project Management)
2. https://nptel.ac.in/courses/106/101/106101061 (Agile Development)

**19CSPX13** **GAME PROGRAMMING** **L T P C**

**3 0 0 3**

**OBJECTIVES**

The main objective of the course is to,

- Get subsequent understanding of game design and development.
- Understand the processes, mechanics and issues in game design.
- Learn the functions game engine development, modeling and techniques.
- Familiarize the handling situations and logic.
- Create interactive games.

**UNIT I 3D GRAPHICS FOR GAME PROGRAMMING 9**

Coordinate Systems, Ray Tracing, Modeling in Game Production, Vertex Processing, Rasterization, Fragment Processing and Output Merging, Illumination and Shaders, Parametric Curves and Surfaces, Shader Models, Image Texturing, Bump Mapping, Advanced Texturing, Character Animation, Physics-based Simulation.

**UNIT II GAME DESIGN PRINCIPLES 9**

Character development, Story Telling, Narration, Game Balancing, Core mechanics, Principles of level design, Genres of Games, Collision Detection, Game Logic, Game AI, Path Finding.

**UNIT III GAMING ENGINE DESIGN 9**

Renderers, Software Rendering, Hardware Rendering, and Controller based animation, Spatial Sorting, Level of detail, collision detection, standard objects, and physics.

**UNIT IV GAMING PLATFORMS AND FRAMEWORKS 9**

Flash, DirectX, OpenGL, Java, Python, XNA with Visual Studio, Mobile Gaming for the Android, iOS, Game engines – Adventure Game Studio, DXStudio, Unity.

**UNIT V GAME DEVELOPMENT 9**

Developing 2D and 3D interactive games using OpenGL, DirectX – Isometric and Tile Based Games, Puzzle games, Single Player games, Multi Player games.

**TOTAL : 45 PERIODS**

**OUTCOMES**

On Completion of the course, the students should be able to,

- Understand game design and development.
- Understand the processes, mechanics and issues in game design.
- Learn the functions game engine development, modeling and techniques.
- Familiarize the handling situations and logic.
- Create interactive games.

**TEXT BOOKS**

1. David H. Eberly, "3D Game Engine Design, Second Edition: A Practical Approach to Real - Time Computer Graphics", Morgan Kaufmann, 2nd Edition, 2006.
2. Jung Hyun Han, "3D Graphics for Game Programming", Chapman and Hall/CRC, 1st Edition, 2011.

**REFERENCES**

1. Ernest Adams and Andrew Rollings, "Fundamentals of Game Design", Prentice Hall, 1st Edition, 2006.
2. Roger E. Pedersen, "Game Design Foundations", 2nd Edition , Jones & Bartlett Learning, 2009.

**E – RESOURCES**

1. https://onlinecourses.nptel.ac.in/noc19_ge32/preview (Introduction to Game Theory)
2. http://www.nptelvideos.in/2012/12/game–theory–and–economics.html (Introduction to Game Theory and Economics)

**19CSPX06** **TOTAL QUALITY MANAGEMENT** **L T P C**

**3 0 0 3**

**OBJECTIVES**

The main objective of this course is to,

- Acquire various concepts of quality management.
- Implement various principles of quality management.
- Impart quality using statistical process.
- Use the various tools to maintain quality.
- Implement the quality system for ISO certification.

**UNIT I INTRODUCTION** **9**

Introduction – Need for quality – Evolution of quality – Definitions of quality – Dimensions of product and service quality – Basic concepts of TQM – TQM framework – Contributions of Deming, Juran and Crosby – Barriers to TQM – Customer focus – Customer orientation, Customer satisfaction, Customer complaints, Customer retention.

**UNIT II TQM PRINCIPLES** **9**

Leadership – Quality statements – Strategic quality planning – Quality councils – Employee involvement – Motivation, empowerment, team and teamwork, recognition, reward and performance appraisal – Continuous process improvement – PDCA cycle, 5S, Kaizen – Supplier partnership, partnering, supplier selection, supplier rating.

**UNIT III TQM TOOLS AND TECHNIQUES – I** **9**

The seven traditional tools of quality – New management tools – Six sigma: Concepts, methodology, applications to manufacturing, service sector including IT – Bench marking, reason to bench mark, bench marking process – FMEA – Stages, types.

**UNIT IV TQM TOOLS AND TECHNIQUES – II** **9**

Quality circles – Cost of quality – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Performance measures.

**UNIT V QUALITY MANAGEMENT SYSTEM 9**

Introduction – Benefits of ISO registration – ISO 9000 series of standards – Specific standards – AS 9100, TS16949 and TL 9000 – ISO 9001 requirements – Implementation – Documentation – Internal audits – Registration – Environmental Management System: Introduction – ISO 14000 series standards – Concepts of ISO 14001 – Requirements of ISO 14001 – Benefits of EMS.

**TOTAL: 45 PERIODS**

**OUTCOMES**

At the end of the course, the students will be able to,

- Acquire various concepts of quality management.
- Implement various principles of quality management.
- Impart quality using statistical process.
- Use the various tools to maintain quality.
- Implement the quality system for ISO certification.

**TEXT BOOKS**

1. Dale H.Besterfiled, "Total Quality Management", Pearson Education Asia, Revised Indian Reprint, Sixth Impression, 3rd Edition, 2013.
2. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2011.

**REFERENCES**

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 1st Indian Edition, Cengage Learning, 2012.
2. Subburaj ramasamy, "Total Quality Management", McGraw Hill Education, Noiad,2011.

**E– RESOURCES**

1. https://nptel.ac.in/courses/110/104/110104080/ (Introduction to Total Quality Management–I)
2. https://nptel.ac.in/courses/110/104/110104085/ (Introduction to Total Quality Management–II)

**19CSPX24 INFORMATION RETRIEVAL TECHNIQUES L T P C**

**3 0 0 3**

**OBJECTIVES**

The main objective of the course is to,

- Learn the information retrieval with AI.
- Understand the basics of Information Retrieval and Modeling.
- Understand various search engine system operations.
- Understand machine learning techniques for text classification and clustering.
- Gain basics of search engines.

**UNIT I INTRODUCTION 9**

Introduction – History of IR – Components of IR – Issues – Open source Search engine Frameworks – The impact of the web on IR – The role of artificial intelligence (AI) in IR – IR Versus Web Search – Components of a Search engine – Characterizing the web.

**UNIT II BASICS OF INFORMATION RETRIEVAL 9**

The Software Architecture of the IR System – The Retrieval and Ranking Processes – The Web – The e-Publishing Era – How the web changed Search – Practical Issues on the Web – How People Search – Search Interfaces Today – Visualization in Search Interfaces.

**UNIT III MODELING AND RETRIEVAL EVALUATION 9**

Basic IR Models – Boolean Model – TF-IDF (Term Frequency/Inverse Document Frequency) Weighting – Vector Model – Probabilistic Model – Latent Semantic Indexing Model – Neural Network Model – Retrieval Evaluation – Retrieval Metrics – Precision and Recall – Reference Collection – User-based Evaluation – Relevance Feedback and Query Expansion – Explicit Relevance Feedback.

**UNIT IV WEB SEARCH ENGINE AND WEB CRAWLING 9**

The Web-Search Engine Architectures – Cluster based Architecture – Distributed Architectures – Search Engine Ranking – Link based Ranking – Simple Ranking Functions – Learning to Rank – Evaluations – Search Engine Ranking – Search Engine User Interaction – Browsing – Applications of a Web Crawler – Taxonomy – Architecture and Implementation – Scheduling Algorithms – Evaluation.

**UNIT V TEXT CLASSIFICATION AND CLUSTERING 9**

A Characterization of Text Classification – Unsupervised Algorithms: Clustering – Naïve Text Classification – Supervised Algorithms – Decision Tree – kNN Classifier – SVM Classifier – Feature Selection or Dimensionality Reduction – Evaluation metrics – Accuracy and Error – Organizing the classes – Indexing and Searching – Inverted Indexes – Sequential Searching – Multi-dimensional Indexing.

**TOTAL: 45 PERIODS**

**OUTCOMES**

Upon completion of the course, the students will be able to,

- Use an open source search engine framework and explore its capabilities.
- Apply appropriate method of classification or clustering.
- Design and implement innovative features in a search engine.
- Design and implement a recommender system.
- Use the classification of texts.

**TEXT BOOKS**

1. Ricardo Baeza-Yates and Berthier Ribeiro-Neto, "Modern Information Retrieval: The Concepts and Technology behind Search", 2nd Edition, ACM Press Books, 2011.
2. Ricci, F, Rokach, L. Shapira, B.Kantor, "Recommender Systems Handbook", 1st Edition, 2011.

**REFERENCES**

1. C. Manning, P. Raghavan, and H. Schütze,"Introduction to Information Retrieval", Cambridge University Press, 2008.
2. Stefan Buettcher, Charles L. A. Clarke and Gordon V. Cormack, "Information Retrieval: Implementing and Evaluating Search Engines", The MIT Press, 2010.

**E – RESOURCES**

1. https://nptel.ac.in/courses/106/101/106101007/ (Introduction,Retrival Evaluation)
2. https://nptel.ac.in/courses/110/107/110107129/ (Clustering, Web Crawling**)**

**PROFESSIONAL ELECTIVE – III**

**19ADPX06** **ETHICS OF ARTIFICIAL INTELLIGENCE** **L T P C**

**3 0 0 3**

**OBJECTIVES**

- Study the morality and ethics in AI
- Learn about the Ethical initiatives in the field of artificial intelligence
- Study about AI standards and Regulations
- Study about social and ethical issues of Robot Ethics
- Study about AI and Ethics- challenges and opportunities

**UNIT I INTRODUCTION** **6**

Definition of morality and ethics in AI-Impact on society-Impact on human psychology-Impact on the legal system-Impact on the environment and the planet-Impact on trust

**UNIT II ETHICAL INITIATIVES IN AI** **6**

International ethical initiatives-Ethical harms and concerns-Case study: healthcare robots, Autonomous Vehicles , Warfare and weaponization.

**UNIT III AI STANDARDS AND REGULATION** **6**

Model Process for Addressing Ethical Concerns During System Design - Transparency of Autonomous Systems-Data Privacy Process- Algorithmic Bias Considerations - Ontological Standard for Ethically Driven Robotics and Automation Systems

**UNIT IV ROBOETHICS: SOCIAL AND ETHICAL IMPLICATION OF ROBOTICS** **6**

Robot-Roboethics- Ethics and Morality- Moral Theories-Ethics in Science and Technology - Ethical Issues in an ICT Society- Harmonization of Principles- Ethics and Professional Responsibility- Roboethics Taxonomy.

**UNIT V AI AND ETHICS- CHALLENGES AND OPPORTUNITIES** **6**

Challenges - Opportunities- ethical issues in artificial intelligence- Societal Issues Concerning the Application of Artificial Intelligence in Medicine- decision-making role in industries-National and International Strategies on AI.

**TOTAL :30 PERIODS**

**OUTCOMES**

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

- Learn about morality and ethics in AI

- Acquire the knowledge of real time application ethics, issues and its challenges.
- Understand the ethical harms and ethical initiatives in AI
- Learn about AI standards and Regulations like AI Agent, Safe Design of Autonomous and Semi-Autonomous Systems
- Understand the concepts of Roboethics and Morality with professional responsibilities.
- Learn about the societal issues in AI with National and International Strategies on AI

**TEXT BOOKS**

1. y. Eleanor Bird, Jasmin Fox-Skelly, Nicola Jenner, Ruth Larbey, Emma Weitkamp and Alan Winfield ,"The ethics of artificial intelligence: Issues and initiatives", EPRS | European Parliamentary Research Service Scientific Foresight Unit (STOA) PE 634.452 — March 2020
2. Patrick Lin, Keith Abney, George A Bekey," Robot Ethics: The Ethical and Social Implications of Robotics", The MIT Press- January 2014.

**REFERENCES**

1. Towards a Code of Ethics for Artificial Intelligence (Artificial Intelligence: Foundations, Theory, and Algorithms) by Paula Boddington, November 2017
2. Mark Coeckelbergh," AI Ethics", The MIT Press Essential Knowledge series, April 2020

**E – RESOURCES**

1. https://sci-hub.mksa.top/10.1007/978-3-540-30301-5_6 (introduction Ethics of AI )
2. https://www.scu.edu/ethics/all-about-ethics/artificial-intelligence-and-ethics-sixteen- challenges-and-opportunities/( Impact on trust)

**19CSPX07** **C# AND .NET PROGRAMMING** **L T P C**

**3 0 0 3**

**OBJECTIVES**

The main objective of the course is to,

- Learn introduction to C#.
- Learn object oriented programming concepts and basic programming in C# .
- Enhance skills in writing Windows applications, ADO.NET and ASP .NET.
- Study the advanced concepts in data connectivity, WPF, WCF and WWF with C# and .NET 4
- Implement mobile applications using .Net compact framework.

**UNIT I INTRODUCTION TO C# 9**

Introducing C# – .Net Architecture – Core C# – Literals – Variables – Data Types – Operators, Expressions – Branching – Looping – Methods – Arrays – Strings – Structures – Enumerations.

**UNIT II OBJECT ORIENTED ASPECTS OF C# 9**

Classes – Objects – Inheritance – Polymorphism – Interfaces – Operator Overloading –Delegates – Events – Generics – Collections – Memory Management and Pointers – Errors and Exceptions – Reflection.

**UNIT III BASE CLASS LIBRARIES AND DATA MANIPULATION 9**

Diagnostics – Tasks, Threads and Synchronization – .Net Security – Localization – Manipulating XML– SAX and DOM – Manipulating files and the Registry – Transactions – ADO.NET– Peer-to-Peer Networking – PNRP – Building P2P Applications – Windows Presentation Foundation (WPF).

**UNIT IV WINDOW BASED APPLICATIONS, WCF AND WWF 9**

Window based applications – Core ASP.NET – ASP.NET Web forms – Windows Communication Foundation (WCF) – Introduction to Web Services – .Net Remoting – Windows Service – Windows Workflow Foundation (WWF) – Activities – Workflows.

**UNIT V .NET FRAMEWORK AND COMPACT FRAMEWORK 9**

Assemblies – Shared assemblies – Custom Hosting with CLR Objects – Appdomains – Core XAML – Bubbling and Tunneling Events– Reading and Writing XAML – .Net Compact Framework – Compact

Edition Data Stores – Errors, Testing and Debugging – Optimizing performance – Packaging and Deployment – Networking and Mobile Devices.

**TOTAL: 45 PERIODS**

**OUTCOMES**

Upon completion of the course, the students will be able to,

- Write various applications using C# Language in the .NET Framework.
- Develop distributed applications using .NET Framework.
- Create mobile applications using .NET compact Framework.
- Identify the working of base class libraries, their operations and manipulation of data using XML.
- Improve writing skills to express thoughts freely.

**TEXT BOOKS**

1. Christian Nagel, Jay Glynn, Morgan Skinner. "Professional C# 5.0 and .NET 4.5.1", Wiley, 2014.
2. Harsh Bhasin, "Programming in C#", Oxford University Press, 2014.

**REFERENCES**

1. Ian Gariffiths, Mathew Adams, Jesse Liberty, "Programming C# 4.0", O_Reilly, 4th Edition, 2010.
2. Andrew Troelsen, Pro C# 5.0 and the .NET 4.5 Framework, Apress publication,2012.

**E – RESOURCES**

1. https://www.udemy.com/course/c–net–for–beginners/ (.NET)
2. https://www.4shared.com/postDownload/xcp4t2awba/Professional_C_50_and_NET_451.html (.NET Programming)

**19CSPX22** **SOFTWARE QUALITY ASSURANCE** **L T P C**

**3 0 0 3**

**OBJECTIVES**

The main objective of the course is to,

- Learn about various concepts, metrics, and models in software quality assurance.
- Study about components of software quality assurance systems before, during,and after software development.
- Impart knowledge on a framework for software quality assurance.
- Discusses about individual components in the framework such as planning, reviews, testing, configuration management, and so on.
- Learn about standards of software quality assurance.

**UNIT I FUNDAMENTALS OF SOFTWARE QUALITY ASSURANCE 9**

The Role of SQA – SQA Plan – SQA considerations – SQA people – Quality Management – Software Configuration Management.

**UNIT II MANAGING SOFTWARE QUALITY 9**

Managing Software Organizations – Managing Software Quality – Defect Prevention – Software Quality Assurance Management.

**UNIT III SOFTWARE QUALITY ASSURANCE METRICS 9**

Software Quality – Total Quality Management (TQM) – Quality Metrics – Software Quality Metrics Analysis.

**UNIT IV SOFTWARE QUALITY PROGRAM 9**

Software Quality Program Concepts – Establishment of a Software Quality Program – Software Quality Assurance Planning – An Overview – Purpose & Scope.

**UNIT V SOFTWARE QUALITY ASSURANCE STANDARDIZATION 9**

Software Standards – ISO 9000 Quality System Standards – Capability Maturity Model and the Role of SQA in Software Development Maturity – SEI CMM Level 5 – Comparison of ISO 9000 Model with SEI's CMM.

**TOTAL: 45 PERIODS**

**OUTCOMES**

Upon completion of the course, the students will be able to,

- Relate Quality Assurance Plan.
- Understand how to conduct formal inspections, record and evaluate results of inspection.
- Apply quality tools and technique in their projects.
- Establish software development with quality plan.
- Explain about standard and certification.

**TEXT BOOKS**

1. Mordechai Ben - Menachem / Garry S Marliss, "Software Quality", Vikas Publishing House, Pvt, Ltd., New Delhi.
2. Watts S Humphrey, "Managing the Software Process", Pearson Education Inc.

**REFERENCES**

1. Gordon G Schulmeyer, "Handbook of Software Quality Assurance", 3rd Edition, Artech House Publishers, 2007.
2. Nina S Godbole, "Software Quality Assurance: Principles and Practice", Alpha Science International, Ltd, 2004.

**E–RESOURCES**

1. https://nptel.ac.in/courses/106/101/106101061/ (Introduction to software engineering Challenges)
2. https://nptel.ac.in/courses/106/105/106105087/ (Basic issues in Software Engineering)

**19CSPX01** **DATA WAREHOUSING AND MINING** **L T P C**

**3 0 0 3**

**OBJECTIVES**

The main objective of the course is to,

- Learn the basics of data mining, data preprocessing and data visualization techniques.
- Understand data warehouse concepts, architecture and business analysis tools.
- Study algorithm for finding hidden patterns and associations in data.
- Know the various classification methods.
- Understand the different clustering and outlier detection methods.

**UNIT I INTRODUCTION** **9**

Introduction to Data Mining Systems – Knowledge Discovery Process – Technologies – Applications – Major issues in Data Mining – Data Objects and Attribute Types – Basic Statistical Descriptions of Data – Data Visualization – Measuring Data Similarity and Dissimilarity – Data Preprocessing.

**UNIT II DATA WAREHOUSING AND ONLINE ANALYTICAL PROCESSING** **9**

Data warehouse: Basic Concepts – Data Cube and OLAP – Data Warehouse Design and Usage – Data Warehouse Implementation – Data Generalization by Attribute – Oriented Induction.

**UNIT III FREQUENT PATTERN ANALYSIS** **9**

Mining Frequent patterns, Associations and Correlations: Basic Concepts – Frequent Item set Mining Methods – Pattern Evaluation Methods – Pattern Mining in Multilevel, Multidimensional Spaces – Constraint-Based Frequent Pattern Mining.

**UNIT IV CLASSIFICATION** **9**

Basic Concepts – Decision Tree Induction – Bayes Classification Methods – Rule-Based Classification – Bayesian Belief Networks – Support Vector Machines – Other Classification Methods.

**UNIT V CLUSTER ANALYSIS AND OUTLIER DETECTION** **9**

Cluster Analysis – Partitioning Methods – Hierarchical Methods – Density-based Methods – Grid-Based Methods – Clustering in High Dimensional Data – Outliers and Outlier Analysis – Outlier Detection Methods

**TOTAL: 45 PERIODS**

**OUTCOMES**

Upon completion of the course, the students will be able to,

- Acquire the knowledge of data mining, data preprocessing and visualization.
- Model and design data warehouse architecture and perform analysis with tools.
- Apply Frequent pattern and association rules mining techniques for data analysis.
- Understand Proper Classification techniques for data analysis.
- Apply suitable Clustering methods for data analysis.

**TEXT BOOKS**

1. Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques", 3rd Edition, Elsevier, 2012.
2. Alex Berson and Stephen J.Smith, "Data Warehousing, Data Mining and OLAP", Tata McGraw – Hill Edition, 13th Reprint, 2008.

**REFERENCES**

1. Pang Ning Tan, Michael Steinbach and Vipin Kumar, "Introduction to Data Mining", Person Education, 2014.
2. Daniel T.Larose, "Data Mining Methods and Models", Wiley – Inderscience, 2006.

**E – RESOURCES**

1. https://nptel.ac.in/courses/110/107/110107092 (Data Mining)
2. https://nptel.ac.in/courses/106/106/106106046 (Classification)

**19CSPX19** **SERVICE ORIENTED ARCHITECTURE** **L T P C**

**3 0 0 3**

**OBJECTIVES**

To enable students to,

- Learn XML concepts and exposed to build applications based on XML.
- Gain knowledge about SAX,DOM and XML to create web services.
- Understand the SOA architecture and principles of Service Oriented Architecture.
- Learn about the role of SOAP and UDDI and web services.
- Know about the SOA design and services in J2EE.

**UNIT I INTRODUCTION TO XML** **9**

XML document structure – Well formed and valid documents – Namespaces – DTD – XML Schema – X-Files.

**UNIT II BUILDING XML– BASED APPLICATIONS** **9**

Parsing XML – using DOM, SAX – XML Transformation and XSL – XSL Formatting – Modeling Databases in XML.

**UNIT III SERVICE ORIENTED ARCHITECTURE** **9**

Characteristics of SOA, Comparing SOA with Client–Server and Distributed architectures – Benefits of SOA – Principles of Service orientation – Service layers.

**UNIT IV WEB SERVICES** **9**

Service descriptions – WSDL – Messaging with SOAP – Service discovery – UDDI – Message Exchange Patterns – Orchestration – Choreography –WS Transactions.

**UNIT V BUILDING SOA–BASED APPLICATIONS** **9**

Service Oriented Analysis and Design – Service Modeling – Design standards and guidelines — Composition – WS-BPEL – WS-Coordination – WS-Policy – WS-Security – SOA support in J2EE**.**

**TOTAL: 45 PERIODS**

**OUTCOMES**

Upon successful completion of this course, students will be able to,

- Build applications based on XML.
- Develop web services using technology elements in databases.
- Able to apply SOA architecture and the underlying design principles for the web projects.
- Build SOA-based applications for intra-enterprise and inter-enterprise applications.
- Able to understand the role of SOA in J2EE and .NET.

**TEXT BOOKS**

1. Ron Schmelzer et al. "XML and Web Services", Pearson Education, 2018.
2. Thomas Erl, "Service Oriented Architecture: Concepts, Technology, and Design", Pearson Education, 2016.

**REFERENCES**

1. Eric Newcomer, Greg Lomow, "Understanding SOA with Web Services", Pearson Education, 2016.
2. Sandeep Chatterjee and James Webber, "Developing Enterprise Web Services: An Architect's Guide", Prentice Hall, 2018.

**E – RESOURCES**

1. http://www.digimat.in/nptel/courses/video/106105167/ (introduction to XML)
2. https://nptel.ac.in/courses/106/105/106105084/ (IP subnetting and addressing)

**19CSPX14** **SOFTWARE PROJECT MANAGEMENT** **L T P C**

**3 0 0 3**

**OBJECTIVES**

The main objective of the course is to,

- Understand the Software Project Planning and Evaluation techniques.
- Plan and manage projects at each stage of the software development life cycle (SDLC).
- Learn about the activity planning and risk management principles.
- Manage software projects and control software deliverables.
- Develop skills to manage the various phases involved in project management and people management.

**UNIT I PROJECT EVALUATION AND PROJECT PLANNING 9**

Importance of Software Project Management – Activities – Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning.

**UNIT II PROJECT LIFE CYCLE AND EFFORT ESTIMATION 9**

Software process and Process Models – Choice of Process models – Rapid Application development – Agile methods – Dynamic System Development Method – Extreme Programming – Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points – COCOMO II-a Parametric Productivity Model.

**UNIT III ACTIVITY PLANNING AND RISK MANAGEMENT 9**

Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Formulating Network Model – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Risk Planning –Risk Management – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical paths – Cost schedules.

**UNIT IV PROJECT MANAGEMENT AND CONTROL 9**

Framework for Management and control – Collection of data – Visualizing progress – Cost monitoring – Earned Value Analysis – Prioritizing Monitoring – Project tracking – Change control – Software Configuration Management – Managing contracts – Contract Management.

**UNIT V STAFFING IN SOFTWARE PROJECTS** **9**

Managing people – Organizational behavior – Best methods of staff selection – Motivation – The Oldham-Hackman job characteristic model – Stress – Health and Safety – Ethical and Professional concerns – Working in teams – Decision making – Organizational structures – Dispersed and Virtual teams – Communications genres – Communication plans – Leadership.

**TOTAL: 45 PERIODS**

**OUTCOMES**

Upon completion of the course, the students will be able to,

- Understand Project Management principles while developing software.
- Gain extensive knowledge about the basic project management concepts, framework and the process models.
- Obtain adequate knowledge about software process models and software effort estimation techniques.
- Estimate the risks involved in various project activities.
- Define the checkpoints, project reporting structure, project progress and tracking mechanisms using project management principles.

**TEXT BOOKS**

1. Gopalaswamy Ramesh, "Managing Global Software Projects", McGraw Hill Education (India), 14th Reprint 2013.
2. Bob Hughes, Mike Cotterell and Rajib Mall: "Software Project Management", 5th Edition, Tata McGraw Hill, New Delhi, 2012.

**REFERENCES**

1. Robert K. Wysocki,"Effective Software Project Management", Wiley Publication, 2011.
2. Walker Royce,"Software Project Management", Addison–Wesley, 1998.

**E – RESOURCES**

1. https://nptel.ac.in/courses/106/105/106105218/ (Software Project Management–Standards)
2. https://nptel.ac.in/noc/courses/noc19/SEM2/noc19–cs70/ (Software Project Management)

**OPEN ELECTIVE – I**

**19ADOX01** **OPERATING SYSTEMS FUNDAMENTALS** **L T P C**

**3 0 0 3**

**OBJECTIVES**

- To understand the basics and functions of operating systems.
- To understand Processes and Threads
- To analyze Scheduling algorithms and process synchronization.
- To understand the concept of Deadlocks.
- To analyze various memory management schemes.
- To be familiar with I/O management and File systems.

**UNIT I INTRODUCTION** **7**

Computer System - Elements and organization; Operating System Overview - Objectives and Functions - Evolution of Operating System; Operating System Structures – Operating System Services - User Operating System Interface - System Calls – System Programs - Design and Implementation - Structuring methods**.**

**UNIT II PROCESS MANAGEMENT** **11**

Processes - Process Concept - Process Scheduling - Operations on Processes - Inter-process Communication; CPU Scheduling - Scheduling criteria - Scheduling algorithms: Threads - Multithread Models – Threading issues; Process Synchronization - The critical-section problem - Synchronization hardware – Semaphores – Mutex - Classical problems of synchronization - Monitors; Deadlock - Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock**.**

**UNIT III MEMORY MANAGEMENT** **10**

Main Memory - Swapping - Contiguous Memory Allocation – Paging - Structure of the Page Table - Segmentation, Segmentation with paging; Virtual Memory - Demand Paging – Copy on Write - Page Replacement - Allocation of Frames –Thrashing.

**UNIT IV STORAGE MANAGEMENT** **10**

Mass Storage system – Disk Structure - Disk Scheduling and Management; File-System Interface - File

concept - Access methods - Directory Structure - Directory organization - File system mounting - File Sharing and Protection; File System Implementation - File System Structure - Directory implementation - Allocation Methods - Free Space Management; I/O Systems – I/O Hardware, Application I/O interface, Kernel I/O subsystem.

**UNIT V VIRTUAL MACHINES AND MOBILE OS 7**

Virtual Machines – History, Benefits and Features, Building Blocks, Types of Virtual Machines and their Implementations, Virtualization and Operating-System Components; Mobile OS - iOS and Android.

**TOTAL : 45 PERIODS**

**OUTCOMES**

Upon completion of the course, the students will be able to,

- Outline the basic services and functionalities of operating systems
- Analyse various scheduling algorithms, and understand the different deadlock
- Prevention and avoidance schemes
- Illustrate the different memory management schemes
- Outline the functionality of file systems
- Compare and contrast Linux, Windows and mobile operating systems

**TEXT BOOKS**

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 9th Edition, John Wiley and Sons Inc., 2018.
2. Andrew S Tanenbaum, "Modern Operating Systems", Pearson, 4th Edition, New Delhi, 2016.

**REFERENCES**

1. Ramaz Elmasri, A. Gil Carrick, David Levine, "Operating Systems – A Spiral Approach", Tata McGraw Hill Edition, 2010.
2. William Stallings, "Operating Systems: Internals and Design Principles", 7th Edition, Prentice Hall, 2018.

**E – RESOURCES**

1. https://nptel.ac.in/courses/106/105/106105214/ (Introduction to Operating Systems)
2. https://nptel.ac.in/courses/106/102/106102132/ (System Calls)

**19ADOX02** **COGNITIVE SCIENCE AND ANALYTICS** **L T P C**

**3 0 0 3**

**OBJECTIVES**

- To know the theoretical background of cognition.
- To understand the link between cognition and computational intelligence.
- To explore probabilistic programming language.
- To study the computational inference models of cognition.
- To study the computational learning models of cognition.

**UNIT I PHILOSOPHY, PSYCHOLOGY AND NEUROSCIENCE 6**

Philosophy: Mental-physical Relation – From Materialism to Mental Science – Logic and the Sciences of the Mind – Psychology: Place of Psychology within Cognitive Science – Science of Information Processing –Cognitive Neuroscience – Perception – Decision – Learning and MemoryLanguage Understanding and Processing.

**UNIT II COMPUTATIONAL INTELLIGENCE 6**

Machines and Cognition – Artificial Intelligence – Architectures of Cognition – Knowledge Based Systems – Logical Representation and Reasoning – Logical Decision Making –Learning – Language – Vision.

**UNIT III PROBABILISTIC PROGRAMMING LANGUAGE 6**

WebPPL Language – Syntax – Using Javascript Libraries – Manipulating probability types and distributions – Finding Inference – Exploring random computation – Coroutines: Functions that receive continuations –Enumeration

**UNIT IV INFERENCE MODELS OF COGNITION 6**

Generative Models – Conditioning – Causal and statistical dependence – Conditional dependence-Data Analysis – Algorithms for Inference.

**UNIT V LEARNING MODELS OF COGNITION 6**

Learning as Conditional Inference – Learning with a Language of Thought – Hierarchical Models– Learning (Deep) Continuous Functions – Mixture Models.

**TOTAL : 30 PERIODS**

**OUTCOMES**

At the end of this course, the students will be able to:

- Understand the underlying theory behind cognition.
- Connect to the cognition elements computationally
- .Implement mathematical functions through WebPPL.
- Develop applications using cognitive inference model.
- Develop applications using cognitive learning model.

**TEXT BOOK**

1. Vijay V Raghavan,Venkat N.Gudivada, VenuGovindaraju, C.R. Rao, Cognitive Computing: Theory and Applications: (Handbook of Statistics 35), Elsevier publications, 2016
2. Judith Hurwitz, Marcia Kaufman, Adrian Bowles, Cognitive Computing and Big Data Analytics, Wiley Publications, 2015

**REFERENCES**

1. Noah D. Goodman, Andreas Stuhlmuller, "The Design and Implementation of Probabilistic Programming Languages", Electronic version of book, https://dippl.org/.
2. Noah D. Goodman, Joshua B. Tenenbaum, The ProbMods Contributors, "Probabilistic Models of Cognition", Second Edition, 2016, https://probmods.org/

**E – RESOURCES**

1. https://onlinecourses.nptel.ac.in/noc22_ee122/preview (philosophy )
2. https://nptel.ac.in/courses/109103134 ( Long term memory encoding)

**19CSOX07** **CUSTOMER RELATIONSHIP MANAGEMENT** **L T P C**
**3 0 0 3**

**OBJECTIVES**

The student should be made to,

- Understand the need and importance of maintaining a good customer relationship.
- Understand the techniques involved in deciding upon customer relationship.
- Learn the CRM structures for better develop business application.
- Understand the CRM implementation Techniques.
- Learn the trends in CRM.

**UNIT I INTRODUCTION** **9**

Definitions – Concepts and Context of relationship Management – Evolution – Transactional Vs Relationship Approach – CRM as a strategic marketing tool – CRM significance to the stakeholders.

**UNIT II UNDERSTANDING CUSTOMERS** **9**

Customer information Database – Customer Profile Analysis – Customer perception , Expectations analysis – Customer behavior in relationship perspectives; individual and group customer's – Customer life time value – Selection of Profitable customer segments.

**UNIT III CRM STRUCTURES** **9**

Elements of CRM – CRM Process – Strategies for Customer acquisition – Retention and Prevention of defection – Models of CRM – CRM road map for business applications.

**UNIT IV CRM PLANNING AND IMPLEMENTATION** **9**

Strategic CRM planning process – Implementation issues – CRM Tools– Analytical CRM – Operational CRM – Call center management – Role of CRM Managers.

**UNIT V TRENDS IN CRM** **9**

E-CRM Solutions – Data Warehousing – Data mining for CRM – an introduction to CRM software packages.

**TOTAL:45 PERIODS**

**OUTCOMES**

Upon the completion of the course, the students will be able to,

- Use strategic customer acquisition and retention techniques in CRM.
- Understanding the customers.
- Develop & planning the CRM structures.
- Implement a trends in CRM techniques.
- Implement the Data Mining for CRM.

**TEXT BOOKS**

1. G.Shainesh, Jagdish, N.Sheth, "Customer Relationships Management Strategic Prespective", Macmillan, 2005.
2. Alok Kumaretal, "Customer Relationship Management : Concepts and applications", Biztantra, 2008.

**REFERENCES**

1. Zikmund,"Customer Relationship Management", Wiley, 2012 .
2. Kumar,"Customer Relationship Management – A Database Approach", Wiley India, 2007.

**E – RESOURCES**

1. https://nptel.ac.in/courses/110/105/110105145/ (Customer Relationship Management)
2. https://nptel.ac.in/noc/courses/noc20/SEM2/noc20–mg57 (Customer Relationship Management)

**19CSOX04** **UNIX INTERNALS** **L T P C**
**3 0 0 3**

**OBJECTIVES**

The main objective of the course is to,

- Get thorough understanding of the kernel.
- Understand the file organization and management.
- Know the various system calls.
- Acquire knowledge of socket architecture, process control & scheduling and memory management.
- Learn the basic concepts of UNIX commands.

**UNIT I INTRODUCTION 9**

History of UNIX-Standards – The process and the kernel-space and context – Process abstraction – executing in kernel mode – synchronization by blocking interrupts – process scheduling – signals.

**UNIT II BUFFER AND INODE 9**

The Buffer Cache – Headers – Buffer Pool –Buffer Retrieval – Reading and Writing DiskBlocks – Advantages and Disadvantages. Internal Representation of Files – Inodes – Structure – Directories – Path Name to Inode – Super Block – Inode Assignment.

**UNIT III FILE SYSTEM INTERFACE AND FRAMEWORK 9**

The user interface to files – File systems – Special files – File system framework – The Vnode/Vfs architecture – Implementation Overview – File System dependent objects – Mounting a file system – Operations on files.

**UNIT IV INTER PROCESS COMMUNICATION 9**

Process Tracing – System V IPC – Network Communications – Sockets – Messages – Message Data Structures – Message Passing Interface – Ports – Name Space – Swapping – Demand Paging – A Hybrid System with swapping and demand paging.

**UNIT V UNIX TOOLS AND PROGRAMMING 9**

Shell programming – UNIX commands – Text processing –s ed and awk utilities – grep utility – Introduction to Lex, Yacc utilities – Introduction to Perl programming.

**TOTAL: 45 PERIODS**

**OUTCOMES**

Upon completion of the course, the students will be able to,

- Provide the basic set of commands and utilities in Linux/UNIX systems.
- Gain an understanding of important aspects related to the files and the process.
- Linux/UNIX library functions and system calls.
- Develop the ability to formulate regular expressions and IPC for pattern matching
- Specify YACC utilities and inspecting file contents

**TEXTBOOKS**

1. Maurice J. Bach, "The Design of the Unix Operating System", Pearson Education,3rd Edition,2018.
2. Vahalia, "Unix Internals: The New Frontiers",4th edition, Pearson Education Inc, 2016.

**REFERENCES**

1. Uresh Vahalia, "UNIX Internals: The New Frontiers", 4th edition, Prentice Hall, 2015.
2. John Lion, "Lion's Commentary on UNIX", 6th Edition, Peer-to-Peer Communications, 2016.

**E–RESOURCES**

1. https://nptel.ac.in/courses/106/102/106102132/ (Introduction to UNIX System Calls)
2. https://nptel.ac.in/courses/106/108/106108101/ (Introduction to Operating system Web)

**19CSOX05** **BIO INFORMATICS** **L T P C**
**3 0 0 3**

**OBJECTIVES**

To enable students to,

- Acquire knowledge wth the domain of bioinformatics.
- Be familiar with mining techniques for bioinformatics.
- Learn the modeling techniques for bioinformatics applications.
- Get exposed to pattern matching and visualization techniques for bio-informatics.
- Learn the microanalysis for genome expression**.**

**UNIT I INTRODUCTION 9**

Need for Bioinformatics technologies – Overview of Bioinformatics technologies Structural bioinformatics – Data format and processing – Secondary resources and applications – Role of Structural bioinformatics – Biological Data Integration System.

**UNIT II DATAMINING FOR BIOINFORMATICS APPLICATIONS 9**

Bioinformatics data – Data ware housing architecture – data quality – Biomedical data analysis – DNA data analysis – Protein data analysis – Machine learning – Neural network architectureApplications in bioinformatics.

**UNIT III MODELING FOR BIOINFORMATICS 9**

Hidden markov modeling for biological data analysis – Sequence identification – Sequence classification – multiple alignment generation – Comparative modeling – Protein modeling – genomic modeling – Probabilistic modeling – Bayesian networks – Boolean networks – Molecular modeling – Computer programs for molecular modeling.

**UNIT IV PATTERN MATCHING AND VISUALIZATION 9**

Gene regulation – motif recognition and motif detection – strategies for motif detection – Visualization – Fractal analysis – DNA walk models – one dimension – two dimension – higher dimension – Game representation of Biological sequences – DNA, Protein, Amino acid sequences.

**UNIT V MICROARRAY ANALYSIS 9**

Microarray technology for genome expression study – image analysis for data extraction – preprocessing – segmentation – gridding , spot extraction , normalization, filtering – cluster analysis – gene network analysis – Compared Evaluation of Scientific Data Management Systems – Cost Matrix – Evaluation model, Benchmark, Tradeoffs.

**TOTAL: 45 PERIODS**

**OUTCOMES**

Upon completion of the course, the students will be able to,

- Understand the concepts of bioinformatics.
- Deploy the datamining techniques in bioinformatics.
- Develop models for biological data.
- Apply pattern matching and visualization techniques for biological sequences.
- Use the microarray technologies for genome expression.

**TEXT BOOKS**

1. Yi–Ping Phoebe Chen (Ed), "Bio Informatics Technologies", 1st Indian Reprint, Springer Verlag, 2007.
2. Arthur M Lesk, "Introduction to Bioinformatics", 2nd Edition, Oxford University Press, 2005.

**REFERENCES**

1. Zoe lacroix and Terence Critchlow, "Bio Informatics – Managing Scientific data", 1st Indian Reprint, Elsevier, 2004
2. Bryan Bergeron, "Bio Informatics Computing", 2nd Edition, Pearson Education, 2003.

**E–RESOURCES**

1. https://nptel.ac.in/courses/102/106/102106065 (Protein Modeling)
2. https://nptel.ac.in/content/storage2/courses/102101007/downloads/PPT/LEC–32–PPT.pdf (Microarray Analysis)

**OPEN ELECTIVE – II**

**19CSOX06** **WEB DESIGNING** **L T P C**
**3 0 0 3**

**OBJECTIVES**

The main objective of the course is to,

- Learn the basic concepts in HTML, CSS, Javascript.
- Understand the responsive design and development.
- Learn the web project management and maintenance process.
- Design a website with HTML, JS, CSS.
- Design a web project with CMS – Word press.

**UNIT I WEB DESIGN – HTML MARKUP FOR STRUCTURE 9**

Working of Web – HTML Markup for Structure – Creating simple page – Marking up text – Adding Links – Adding Images – Table Markup – Forms – HTML5.

**UNIT II CSS AND JAVASCRIPT 9**

CSS – Formatting text – Colours and Background – Padding, Borders and Margins – Floating and positioning – Page Layout with CSS – Transition, Transforms and Animation – Javascript – using Java Script.

**UNIT III RESPONSIVE WEB DESIGN 9**

Sass for Responsive Web Design – Marking Content with HTML5 – Mobile-First or Desktop-First – CSS Grids, CSS Frameworks, UI Kits, and Flexbox for RWD – Designing small UIs by Large Finger – Images and Videos in Responsive Web Design – Meaningful Typography for Responsive Web Design.

**UNIT IV ON-LINE APPLICATIONS 9**

Simple applications – On-line Databases – Monitoring user events – Plugins – Database Connectivity – Internet information Systems – EDI application in business – Internet commerce Customization of Internet commerce.

**UNIT V PROJECT CASE STUDY 9**

Using HTML, CSS, JS or using Open source CMS like Word Press, design and develop a Website

having Aesthetics, Advanced and Minimal UI Transitions based on the project – Host and manage the project live in any public hosting.

**TOTAL: 45 PERIODS**

**OUTCOMES**

On Successful completion of the course ,Students will be able to,

- Design Website using HTML CSS and JS.
- Design Responsive Sites.
- Manage, Maintain and Support Web Apps.
- Design a simple Applications.
- Maintain a Database connectivities.

**TEXT BOOKS**

1. Jennifer Niederst Robbins, "Learning Web Design", O'REILLY, 4th Edition, 2012.
2. Ricardo Zea, "Mastering Responsive Web Design", PACKT Publishing, 2015.

**REFERENCES**

1. Jon Duckett, "HTML and CSS: Design and Build Websites", John Wiley and Sons,3rd Edition, 2014.
2. Uttam K. Roy, "Web Technologies", Oxford University Press, 13th Impression, 2017.

**E – RESOURCES**

1. https://nptel.ac.in/courses/106/106/106106156/ (Introduction to Modern Application Development)
2. https://nptel.ac.in/courses/106/105/106105084/ (Introduction to Internet)

**19ADOX03 PARALLEL AND DISTRIBUTED COMPUTING**

**L T P C**
**3 0 0 3**

**OBJECTIVES**

To enable the students to,

- To understand different parallelism techniques
- To know parallel architecture and parallel algorithm design.
- Understand parallel programming
- To introduce the computation and communication models of distributed systems
- To illustrate the issues of synchronization and collection of information in distributed systems
- To describe distributed mutual exclusion and distributed deadlock detection techniques

**UNIT I INTRODUCTION TO PARELLEL COMPUTING 9**

Historical progression leading to current state – types of parallism including temporal, data and functional. Instructional level parallelism – pipelined processors – super scalar processors – VLIW processors – multithreaded processors – proposed future processors including trace, multiscalar and super flow – case studies

**UNIT II PARALLEL ARCHITECTURES 9**

Classification – inter connection networks – vector computers – shared memory parallel computers – cache coherence – distributed shared memory parallel computers – message passing parallel computers – cluster of workstations.

**UNIT III INTRODUCTION TO DISTRIBUTED COMPUTING 9**

Introduction: Definition-Relation to Computer System Components – Motivation – Message - Passing Systems versus Shared Memory Systems – Primitives for Distributed Communication – Synchronous versus Asynchronous Executions – Design Issues and Challenges; A Model of Distributed Computations: A Distributed Program – A Model of Distributed Executions – Models of Communication Networks – Global State of a Distributed System.

**UNIT IV LOGICAL TIME AND GLOBAL STATE 9**

Logical Time: Physical Clock Synchronization: NTP – A Framework for a System of Logical Clocks – Scalar Time – Vector Time; Message Ordering and Group Communication: Message Ordering Paradigms – Asynchronous Execution with Synchronous Communication – Synchronous Program Order on

Asynchronous System – Group Communication – Causal Order – Total Order; Global State and Snapshot Recording Algorithms: Introduction – System Model and Definitions – Snapshot Algorithms for FIFO Channels.

**UNIT V DISTRIBUTED MUTEX AND DEADLOCK 9**

Distributed Mutual exclusion Algorithms: Introduction – Preliminaries – Lamport's algorithm – Ricart-Agrawala's Algorithm — Token-Based Algorithms – Suzuki-Kasami's Broadcast Algorithm; Deadlock Detection in Distributed Systems: Introduction – System Model – Preliminaries – Models of Deadlocks – Chandy-Misra-Haas Algorithm for the AND model and OR Model.

**TOTAL: 45 PERIODS**

**OUTCOMES**

Upon completion of the course, the students will be able to,

- Understand different parallel computing technique
- Learn parallel computing architecture
- Learn to design parallel algorithms
- Explain the foundations of distributed systems
- Solve synchronization and state consistency problems
- Use resource sharing techniques in distributed systems

**TEXT BOOKS**

1. V. Rajaraman and C. Siva Ram Murthy, "Parallel Computers – Architecture and Programming", Prentice-Hall of India, 2003.
2. Ananth Grama, Anshul gupta, George Karypis and Vipin Kumar, "Introduction to Parallel Computing", Pearson Education, Second edition, 2004.

**REFERENCES**

1. Selim G.Akl – The design and analysis of parallel algorithms – Prentice Hall International Inc, 1989.
2. Hwang K. Briggs F.A. – Computer Architecture and parallel processing – MCGraw Hill – 1985

**E–RESOURCES**

1. https://nptel.ac.in/courses/106102114 (Introduction - Parallel Computing)
2. https://nptel.ac.in/courses/106102163 (Parallel Computing concepts)

**19CSOX08 E-COMMERCE AND APPLICATIONS** **L T P C**
**3 0 0 3**

**OBJECTIVES**

To enable the students to,

- Learn Efficient at selling through understanding complex consumer behavior.
- Learn national goals and aspirations as well as towards E-commerce infrastructure.
- Understand Maximise conversion rates in E-business.
- Learn up-sell and cross-sell products and services to maximise value over the lifetime of the customer.
- Understand technical and economical challenges doing E-Marketing.

**UNIT I INTRODUCTION** **9**

Introduction to Electronic Commerce – History of Electronic Commerce – Cutting edge –Electronic Commerce Framework – Evolution of E-commerce – Advantages and Disadvantage of E-commerce.

**UNIT II NETWORK INFRASTRUCTURE** **9**

Network Infrastructure – The Internet Hierarchy – Basic Blocks of e-commerce – Networks layers & TCP/IP protocols – The Advantages of Internet – World Wide Web – E-commerce Infrastructure.

**UNIT III E–COMMERCE INFRASTRUCTURE** **9**

An Overview of Hardware, Server Operating System, Software, Network Website – Managing the e-Enterprise – E-business Enterprise – Comparison between Conventional Design and E-organisation.

**UNIT IV PROCESS MODELS AND PAYMENT SYSTEMS** **9**

E-business Models Based on the Relationship of Transaction Parties – e-commerce Sales Life Cycle (ESLC) Model – Electronic Payment Systems – Electronic Cash – Smart Cards and Electronic Payment Systems.

**UNIT V ELECTRONIC DATA INTERCHANGE(EDI)** **9**

EDI – History of EDI – EDI Working Concept – Implementation difficulties of EDI – Financial EDI – EDI and Internet – E-Marketing – The scope of E-Marketing.

**TOTAL: 45 PERIODS**

**OUTCOMES**

Upon completion of the course, the students will be able to,

- Learn to Faster buying process and product listing creation.
- Use an affordable advertising and marketing.
- Flexibility for customers and price comparison.
- Give Faster response to buyer/market demands.
- Use an incorporate social elements.

**TEXT BOOKS**

1. P.T.Joseph, " E-Commerce An Indian Perspective",3rd Edition,Prentice–Hall of India, 2016.
2. J.O'Brien, "Management Information Systems",15th Edition, Tata Mcgraw–Hill, 2018.

**REFERENCES**

1. J. F.Rayport, & B. J. Jaworski,"Introduction to E–Commerce", 2nd Edition,New York McGraw–Hill Irwin.
2. R. M. Stair, & G. W. Reynolds,"Principles of Information Systems", 5th Edition, Singapore Thomson Learning.

**E–RESOURCES**

1. https://nptel.ac.in/courses/110/105/110105083/ (E–Business)
2. https://nptel.ac.in/noc/courses/noc18/SEM1/noc18–ma04/l (Calculus for Economics, Commerce and Management)

**19CSOX09** **SOCIAL NETWORK ANALYSIS** **L T P C**
**3 0 0 3**

**OBJECTIVES**

The main objective of the course is to,

- Understand the concept of semantic web and related applications.
- Know the aggregation and knowledge representation.
- Learn knowledge representation using ontology.
- Understand human behaviour in social web and related communities.
- Learn visualization of social networks.

**UNIT I INTRODUCTION** **9**

Introduction to Semantic Web: Limitations of current Web – Development of Semantic Web – Emergence of the Social Web – Social Network analysis: Development of Social Network Analysis – Key concepts and measures in network analysis – Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities – Web-based networks – Applications of Social Network Analysis.

**UNIT II MODELLING, AGGREGATING AND KNOWLEDGE REPRESENTATION** **9**

Ontology and their role in the Semantic Web: Ontology–based knowledge Representation – Ontology languages for the Semantic Web: Resource Description Framework – Web Ontology Language – Modelling and aggregating social network data: State-of-the-art in network data representation – Ontological representation of social individuals – Ontological representation of social relationships – Aggregating and reasoning with social network data – Advanced representations.

**UNIT III EXTRACTION AND MINING COMMUNITIES IN WEB SOCIALNETWORKS** **9**

Extracting evolution of Web Community from a Series of Web Archive – Detecting communities in social networks – Definition of community – Evaluating communities – Methods for community detection and mining – Applications of community mining algorithms – Tools for detecting communities social network infrastructures and communities – Decentralized online social networks – Multi-Relational characterization of dynamic social network communities.

**UNIT IV PREDICTING HUMAN BEHAVIOUR AND PRIVACY ISSUES** **9**

Understanding and predicting human behaviour for social communities – User data management –

Inference and Distribution – Enabling new human experiences – Reality mining – Context – Awareness – Privacy in online social networks – Trust in online environment – Trust models based on subjective logic – Trust network analysis – Trust transitivity analysis – Combining trust and reputation – Trust derivation based on trust comparisons – Attack spectrum and countermeasures.

**UNIT V VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS 9**

Graph theory – Centrality – Clustering – Node-Edge Diagrams – Matrix representation – Visualizing online social networks, Visualizing social networks with matrix-based representations – Matrix and Node – Link Diagrams – Hybrid representations – Applications – Cover networks – Community welfare – Collaboration networks – Co-Citation networks.

**TOTAL: 45 PERIODS**

**OUTCOMES**

Upon completion of the course, the students should be able to,

- Develop semantic web related applications.
- Understanding the aggregation and knowledge representation.
- Represent knowledge using ontology.
- Predict human behaviour in social web and related communities.
- Visualize social networks.

**TEXT BOOKS**

1. Peter Mika,"Social Networks and the Semantic Web", 1st Edition, Springer, 2007.
2. Borko Furht, "Handbook of Social Network Technologies and Applications", 1st Edition, Springer, 2010.

**REFERENCES**

1. GuandongXu ,Yanchun Zhang and Lin Li, 'Web Mining and Social Networking – Techniques and applications', 1st Edition, Springer, 2011.
2. Dion Gohand Schubert Foo,'Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively', IGI Global Snippet, 2008.

**E–RESOURCES**

1. https://nptel.ac.in/courses/106/106/106106169/ (Social Networks)
2. https://nptel.ac.in/noc/courses/noc17/SEM2/noc17–cs41/ (Social Networks–Introduction)

**19CSOX10** **MULTIMEDIA SYSTEMS** **L T P C**
**3 0 0 3**

**OBJECTIVES**

The student should be able to,

- Develop an understanding and awareness of how issues such as content, information architecture, motion, sound, design, and technology.
- Merge to form effective and compelling interactive experiences for a wide range of audiences and end users.
- Be aware of current issues relative between new emerging electronic technologies and graphic design.(i.e. social, cultural, cognitive, etc).
- Appreciate the importance of technical ability and creativity within design practice.
- To understand the planning and costing strategies.

**UNIT I INTRODUCTION OF MULTIMEDIA 9**

Definitions – CD-ROM and the Multimedia Highway – where to use Multimedia – introduction to Making Multimedia: The stages of a Project – What you need – Multimedia Skills and Training : The terms – Macintosh and Windows Production Platforms:Multimedia PC platform – Networking Macintosh and Windows Computers – Hardware Peripherals Connection – Memory and Storage Devices – Input Devices – Output Hardware.

**UNIT II BASIC TOOLS 9**

Text Editing and Word Processing Tools – OCR Software – Painting and Drawing Tools – 3-D Modeling and Animation Tools – Image – Editing Tools – Sound Editing Tools – Animation, Video and Digital Movies Tools – Helpful Accessories – Making Instant Multimedia: Linking Multimedia Objects – Office Suites – Word Processors – Spread sheets – Databases – Presentation Tools. Multimedia Authoring Tools.

**UNIT III TEXT IN MULTIMEDIA 9**

The Power of Meaning – About Fonts and Faces – Using Text in Multimedia – Computers and Text – Font Editing and Design Tools – Hypermedia and Hypertext – Sound: The Power of Sound – Multimedia System Sounds – MIDI Versus Digital Atidid – Digital Audio – Making MIDI Audio – Audio File Formats – Notation Interchange File Format (NIFF) – Adding Sound to Your multimedia Project – Toward professional Sound.

**UNIT IV ANIMATION AND FILE FORMATS 9**

Making Still Images – Color – Image File Formats. Animation: The Power of Motion – Principles of Animation – Making Animations That Work – Video: Using video – How video works – Broadcast Video Standards – Integrating Computers and Television – Shooting and Editing Video – Video Tips – Recording Formats – Digital Video.

**UNIT V PLANNING AND COSTING 9**

Project planning – Estimating – Designing and producing: Designing – Producing – Content and Talent: Acquiring Content – Using content created by others – Using Content created for a Project – Using Talent Delivering: Testing – Preparing for Delivery – Delivering on CD-ROM – Compact Disc Technology – Wrapping It Up – Delivering on the World Wide Web.

**TOTAL: 45 PERIODS**

**OUTCOMES**

Upon completion of the course, the student should be able to,

- Form effective and compelling interactive experiences for a wide range of audiences.
- Effectively and Creatively solve a wide range of graphic design problems.
- Discuss issues related to emerging electronic technologies and graphic design.
- Learn the usage of multimedia.
- Develop the creative multimedia tools.

**TEXT BOOKS**

1. Donald Hearn and M. Pauline Baker, "Computer Graphics C Version", Pearson Education, 2003.
2. Andleigh, P. K and Kiran Thakrar, "Multimedia Systems and Design", PHI, 2003.

**REFERENCES**

1. Tay Vaughan ,"Multimedia : Making it work",7th Edition, Tata McGraw–Hill,2006.
2. John F Koegel Buford,"Multimedia Systems", 1st Indian Reprint, Addison Wesley,2000.

**E–RESOURCES**

1. https://nptel.ac.in/courses/117/105/117105083/ (Multimedia Processing web)
2. https://nptel.ac.in/courses/106/106/1061062l00 (Multimodal Interaction)

## GENERAL ELECTIVE

**19NCCL01 NCC AIRFORCE LEVEL-1 L T P C**
**2 0 2 3**

**Course Prerequisites : 75% Attendance in First Year of NCC**

**OBJECTIVES**

The course is intended to,

- learn about the basic structure of NCC and its organization, Incentives, duties of Cadets, imbibe the knowledge of various types of Camp.
- Motivate the cadets as confidence leaders by refining their personality and self awareness, with the help of Communication skills and aware of creative, critical thinking abilities.
- Create a pool of organized, trained and motivated youth with leadership qualities in all walks of life from the exposure of great leaders and their history.
- Inspire the cadets to take part in the Social Service Activities and also motivate them to know about their role in the society towards the development of Nation.
- Acquire knowledge about the basics of health and hygiene, yoga, environment cleanliness and motivate young Indians towards the path of clean India and acquaint about obstacle training.

**UNIT I NCC GENERAL 6**

Aims, objectives and Organization of NCC – incentives - duties of NCC Cadets - NCC camps - types - conduct.

**UNIT II PERSONALITY DEVELOPMENT 6**

Personality Development – Factors - Self Awareness - Communication skills – Empathy - Critical and Creative thinking - Decision making.

**UNIT III LEADERSHIP 6**

Leadership Capsule – Traits - Case studies - leaders like APJ Abdul Kalam, RatanTata, Shivaji, Tipu Sultan, Rabindranath Tagore, N Narayana murthy.

**UNIT IV SOCIAL SERVICE 6**

Social Service Capsule – Basics - Rural development programmes – NGOs - Contribution of Youth - Swatch Bharath Abhiyan, Social evils - Drug Abuse - Digital Awareness - Waste Management -Women Health and

Sanitation - Tree Plantation - Traffic Awareness - Pollution.

**UNIT V HEALTH AND HYGIENE 6**

Hygiene and sanitation – First Aid – Introduction to Yoga – Adventure – Environmental awareness and conservation – Obstacle Training -Adventure

**PRACTICAL COMPONENT 10**

| S.No. | Name of the Experiment | CO Mapping | RBT |
|---|---|---|---|
| 1 | Foot Drill | CO1 | Apply |
| 2 | Rifle Drill | CO1 | Apply |
| 3 | Ceremonial Drill | CO2 | Understand |
| 4 | Social Service and Community Development | CO4 | Apply |

**TOTAL : 35+10 = 45 PERIODS**

**OUTCOMES**

Upon the successful completion of this course students will be able to

- Understand the basic organization of NCC and roles, responsibilities of cadets for the smooth functioning of all camps.
- Develop the cadets personality and to think divergently to break functional fixedness.
- Identify the Leadership traits from the admiration and qualities of great leaders.
- Understand the concept and important of Social service and influence them to spread awareness about various activities.
- Practice healthy practices to improve the personal sanitation and hygiene and get into the adventurous activities.

**TEXT BOOKS**

1. Cadet Hand Book (Specialized Subjects), published by DGNCC.
2. ANO Handbook

**REFERENCES**

1. Grooming tomorrow's Leaders, published by DG, NCC.
2. Youth in Action, published by DG,NCC.

3. The Cadet, Annual Journal of the NCC.
4. Précis Issued by respective Service Headquarters on specialized subject available to PI Staff as reference material.

**E - RESOURCES**

1. https://www.indiancc.nic.in
2. https://www.indiancc.mygov.in
3. https://www.play.google.com/MY_IAF
4. https://www.play.google.com/DGNCC_Training

**19NCCL02 NCC AIRFORCE LEVEL - 2 L T P C**

**2 0 2 3**

**Course Prerequisites : 75% Attendance in Second Year of NCC**

**OBJECTIVES**

The course is intended to

- Realize the importance of national security and threats for the nation and aware of National Integration.
- Create interest in cadet to develop into great leaders by teaching them about problem solving techniques, handling emotions, time management skills.
- Aware of disaster management and motivate the young minds to help during the time of disasters.
- Create a pool of organized, trained and motivated youth with authoritative qualities to serve in IAF and to know the significance of Airmanship, Air Campaigns
- To learn about the Aero Modelling for better understanding of flying and also to choose the Armed Forces as a career.

**UNIT I NATIONAL INTEGRATION AND AWARENESS 6**

National Integration and Awareness - importance and necessity - factors affecting National integration - Unity in Diversity - Threats to National Security.

**UNIT II PERSONALITY DEVELOPMENT 6**

Problem solving- - Group discussions-Coping with stress and emotions-Change your mindset-Time management-Social skills-Team work-public speaking.

**UNIT III DISASTER MANAGEMENT 6**

Disaster Management Capsule – Organization - Types -Essential services – Assistance - Civil Defence Organization. Initiative training - organizing skills - Dos and Don't's. Fire Services and Fire Fighting.

**UNIT IV GENERAL SERVICE KNOWLEDGE ON AIRCRAFT AND AIRMANSHIP 6**

Armed forces and IAF Capsule-Modes of Entry in IAF-Aircraft types, capabilities and role-Air Campaigns-Principle of Flight-Forces acting on Aircraft-Airmanship – Navigation.

**UNIT V AERO MODELLING** **6**

Introduction and Types of Aero Engine – Aircraft Controls – Introduction to Radars – Aero modelling capsule – Flying/Building of Aero models – Micro Light Flying – Simulator Flying.

**PRACTICAL COMPONENT** **10**

| S.No. | Name of the Experiment | CO Mapping | RBT |
|---|---|---|---|
| 1 | Foot Drill | CO1 | Apply |
| 2 | Rifle Drill | CO1 | Apply |
| 3 | Weapon Assembling and Reassembling | CO2 | Understand |
| 4 | Basics of Aero modelling | CO4 | Apply |

**TOTAL: 35+10 = 45 PERIODS**

**OUTCOMES**

Upon the successful completion of this course students will be able to,

- Realize the importance of National integration, threats and factors affecting the National Security.
- demonstrate their public speaking skills and problem solving techniques
- Identify the problems during Disaster type and to give solutions during the emergency periods with their divergent thinking
- Grasp the concept of IAF and its importance to the nation and detailed Knowledge on Aircraft and Airmanship
- Obtain knowledge on Aero Modelling, handle of radars and insight about Aircraft, Aero models and flying.

**TEXT BOOKS**

1. Cadet Hand Book (Common Subjects), published by DGNCC.
2. Cadet Hand Book (Specialized Subjects), published by DGNCC.
3. ANO Hand Book

**REFERENCES**

1. Grooming tomorrow's Leaders, published by DG, NCC.
2. Youth in Action, published by DG,NCC.
3. The Cadet, Annual Journal of the NCC.

4. Précis Issued by respective Service Headquarters on specialized subject available to PI Staff as reference material.

**E - RESOURCES**

1. https://www.indiancc.nic.in
2. https://www.indiancc.mygov.in
3. https://www.play.google.com/MY_IAFs
4. https://www.play.google.com/DGNCC_Training

## LIST OF HUMANITIES AND SOCIAL SCIENCES (HS) COURSES

| Course Code | Name of the Subject | Category | Periods / Week | | | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | C | CIA | ESE | TOT |
| 19HST101 | Communicative Techno English–I | HS | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 19HST201 | Communicative Techno English–II | HS | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 19MGT501 | Engineering Economics and Management | HS | 3 | 0 | 0 | 3 | 40 | 60 | 100 |

## LIST OF BASIC SCIENCES (BS) COURSES

| Course Code | Name of the Subject | Category | Periods / Week | | | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | C | CIA | ESE | TOT |
| 19MAT101 | Engineering Mathematics – I | BS | 3 | 1 | 0 | 4 | 40 | 60 | 100 |
| 19PHE101 | Integrated Industrial Physics | BS | 3 | 0 | 2 | 4 | 40 | 60 | 100 |
| 19CYE101 | Engineering Chemistry | BS | 3 | 0 | 2 | 4 | 40 | 60 | 100 |
| 19CYT201 | Environmental Science and Engineering | BS | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 19MAT201 | Engineering Mathematics – II | BS | 3 | 1 | 0 | 4 | 40 | 60 | 100 |
| 19PHT202 | Solid State Physics and Nano Electronic Devices | BS | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 19MAT301 | Transforms and Partial Differential Equation | BS | 3 | 1 | 0 | 4 | 40 | 60 | 100 |
| 19MAT406 | Essential of Mathematics for Machine Learning | BS | 3 | 1 | 0 | 4 | 40 | 60 | 100 |

## LIST OF ENGINEERING SCIENCES (ES) COURSES

| Course Code | Name of the Subject | Category | Periods / Week | | | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | C | CIA | ESE | TOT |
| 19GET101 | Engineering Graphics | ES | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 19GEE101 | Computer Fundamentals and Python Programming | ES | 3 | 0 | 2 | 4 | 40 | 60 | 100 |
| 19GET201 | Fundamentals of Electrical Electronics and Instrumentation | ES | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 19ECE304 | Digital Principles and Computer Architecture | ES | 3 | 0 | 2 | 4 | 50 | 50 | 100 |

## LIST OF EMPLOYABILITY ENHANCEMENT COURSES (EEC)

| Course Code | Name of the Subject | Category | Periods / Week | | | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | C | CIA | ESE | TOT |
| 19EEC101 | Life Skills for Engineers | EEC | 2 | 0 | 0 | 0 | 100 | – | 100 |
| 19EEC202 | Technical Skill (Multimedia) | EEC | 0 | 0 | 2 | 0 | 100 | – | 100 |
| 19EEC301 | Communication Skills | EEC | 0 | 0 | 2 | 0 | 100 | – | 100 |
| 19EEC302 | Entrepreneurship Development Activities | EEC | 1 | 0 | 0 | 0 | 100 | – | 100 |
| 19EEC501 | Quantitative Aptitude Learning | EEC | 2 | 0 | 0 | 0 | 100 | – | 100 |
| 19ADJ601 | Mini Project | EEC | 0 | 0 | 2 | 1 | 100 | – | 100 |
| 19ADJ701 | Project Phase I | EEC | 0 | 0 | 2 | 1 | 40 | 60 | 100 |
| 19ADJ801 | Project Phase II | EEC | 0 | 0 | 20 | 10 | 40 | 60 | 100 |

**LIST OF MANDATORY COURSES (MC)**

| Course Code | Name of the Subject | Category | Periods / Week | | | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | C | CIA | ESE | TOT |
| 19MDC101 | Induction Program(2 Weeks) | MC | – | – | – | – | – | – | – |
| 19MDC201 | NSS/YRC/RRC | MC | – | – | – | – | 100 | – | 100 |
| 19MDC301 | Leadership Enhancement Programme | MC | 1 | 0 | 0 | 0 | 100 | – | 100 |
| 19MDC401 | Value Added Course – I | MC | 0 | 0 | 2 | 0 | 100 | – | 100 |
| 19MDC501 | Value Added Course – II | MC | 0 | 0 | 2 | 0 | 100 | – | 100 |
| 19MDC601 | Constitution of India | MC | 3 | 0 | 0 | 0 | 100 | – | 100 |

**CURRICULUM AND SYLLABI**

**FOR B.E. / B.TECH. DEGREE PROGRAMMES**

**(For the Students Admitted in the Academic Year 2022-2023 onwards)**

**CREDIT SUMMARY**

**B.Tech. - ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**

| Category | I | II | III | IV | V | VI | VII | VIII | Credit total |
|---|---|---|---|---|---|---|---|---|---|
| HS | 3 | 3 | - | - | 3 | - | - | - | 9 |
| BS | 12 | 10 | 4 | 4 | - | - | - | - | 30 |
| ES | 7 | 3 | 4 | - | - | - | - | - | 14 |
| PC | - | 4 | 15 | 19 | 19 | 15 | 8 | - | 80 |
| PE | - | - | - | - | - | 3 | 6 | 3 | 12 |
| OE | - | - | - | - | - | 3 | - | 3 | 6 |
| EEC | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 10 | 12 |
| MC | - | - | - | - | - | - | - | - | - |
| TOTAL | 22 | 20 | 23 | 23 | 22 | 22 | 15 | 16 | 163 |

# DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

# REGULATION-2019

# MINOR DEGREE/HONOURS

# FULL STACK DEVELOPMENT

# CURRICULUM AND SYLLABI

# CURRICULUM AND SYLLABI

## FOR B.E. / B.Tech. DEGREE PROGRAMMES

## (MINOR / HONOURS DEGREE)

## FULL STACK DEVELOPMENT

## B.Tech. – ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

| Course Code | Name of the Subject | Category | Periods / Week | | | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | C | CIA | ESE | TOT |
| **THEORY** | | | | | | | | | |
| 19ADFT01 | Client-Server Scripting Languages | PC | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 19ADFT02 | UI and UX Design | PC | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 19ADFT03 | Software Testing and Automation | PC | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 19ADFE01 | Cloud Computing Services | PC | 3 | 0 | 2 | 4 | 50 | 50 | 100 |
| 19ADFP01 | Project Work | EEC | 0 | 0 | 10 | 6 | 40 | 60 | 100 |
| **Total Credits** | | | **19** | | | | | | |

PC : Professional Core
EEC : Employability Enhancement Courses
L : Lecture
T : Tutorial
P : Practical
C : Credit Point
CIA : Continuous Internal Assessment
ESE : End Semester Examination
TOT : Total

**SEMESTER - III**

**19ADFT01 CLIENT-SERVER SCRIPTING LANGUAGES L T P C**
**3 0 0 3**

**OBJECTIVES**

- To understand the fundamental principles of web development.
- To learn about to handle HTTP requests and responses on the server-side.
- To learn how to use AJAX, RESTful API and JSON concepts.
- To study about Implementation of user registration and login functionality.
- To understand and implement security best practices for web applications to prevent common vulnerabilities.

**UNIT I INTRODUCTION TO WEB DEVELOPMENT AND CLIENT-SIDE SCRIPTING 9**

Introduction to web development principles, Overview of client-server architecture, Setting up the development environment, Basics of HTML, CSS, and JavaScript, DOM manipulation and event handling.

**UNIT II SERVER-SIDE SCRIPTING FUNDAMENTALS 9**

Introduction to server-side scripting languages (e.g., PHP, Node.js, Python, or Ruby), Handling HTTP requests and responses, Working with server-side databases, Implementing basic server-side logic.

**UNIT III COMMUNICATION BETWEEN CLIENT AND SERVER 9**

AJAX (Asynchronous JavaScript and XML) for client-server communication, RESTful API concepts and implementation, Data exchange between client and server, JSON (JavaScript Object Notation) and its usage.

**UNIT IV DATA STORAGE AND USER MANAGEMENT 9**

Introduction to databases (e.g., MySQL, MongoDB, or PostgreSQL), CRUD operations using server-side scripting languages, Implementing user registration and login functionality, User authentication and authorization.

**UNIT V ADVANCED TOPICS AND PROJECT DEVELOPMENT 9**

Front-end frameworks (e.g., React, Angular, or Vue.js) and integrating them with server-side scripts, Server-side templating and generating dynamic content, Security best practices for web applications, Deployment and hosting options for web applications, Final project development: Students work on a comprehensive web application that demonstrates the skills learned throughout the course.

**TOTAL : 45 PERIODS**

**OUTCOMES**

Upon completion of this course, Students will be able to:

- Explain the web development principles and the client-server architecture.
- Create server-side databases and implement basic server-side logic to process data and generate dynamic content.
- Explain about AJAX (Asynchronous JavaScript and XML), concepts of RESTful APIs and JSON (JavaScript Object Notation).
- Develop user registration and login functionality with user authentication and authorization features.
- Describe about deployment and hosting options for web applications.

**TEXT BOOKS**

1. David Flanagan, O'Reilly Media, "JavaScript: The Definitive Guide", Inc. Publications, 7th Edition, 2020.
2. Mario Casciaro and Luciano Mammino, "Node.js Design Patterns"**,** Packt Publishing Limited Publications, 2020.

**REFERENCES**

1. Miguel Grinberg , " Flask Web Development: Developing Web Applications with Python", Shroff/O'Reilly Publications, Second Edition, 2018.
2. Eve Porcello, Alex Banks, "Learning React: Modern Patterns for Developing React Apps", O'Reilly Publications, Second Edition, 2020.

**E-RESOURCES**

1. https://developer.mozilla.org/en-US/docs/Web/JavaScript (MDN Web Docs - JavaScript)
2. https://nodejs.org/en/docs/ (Node.js Official Documentation)

**SEMESTER IV**

| | | |
|---|---|---|
| **19ADFT02** | **UI AND UX DESIGN** | **L T P C**<br>**3 0 0 3** |

**OBJECTIVES**

- To understand the fundamental concepts of design and design thinking
- To learn the principles and elements of UI design
- To understand the concept of User Experience (UX) and its significance in the success of products and services
- To learn with practical skills in creating wireflows and prototypes to test and validate design ideas before implementation
- To study various research and ideation techniques and create a solid information architecture for products

**UNIT I FOUNDATIONS OF DESIGN 9**

UI vs. UX Design - Core Stages of Design Thinking - Divergent and Convergent Thinking - Brainstorming and Game storming - Observational Empathy

**UNIT II FOUNDATIONS OF UI DESIGN 9**

Visual and UI Principles - UI Elements and Patterns - Interaction Behaviors and Principles – Branding - Style Guides

**UNIT III FOUNDATIONS OF UX DESIGN 9**

Introduction to User Experience - Why You Should Care about User Experience - Understanding User Experience - Defining the UX Design Process and its Methodology - Research in User Experience Design - Tools and Method used for Research - User Needs and its Goals - Know about Business Goals

**UNIT IV WIREFRAMING, PROTOTYPING AND TESTING 9**

Sketching Principles - Sketching Red Routes - Responsive Design – Wireframing - Creating Wireflows - Building a Prototype - Building High-Fidelity Mockups - Designing Efficiently with Tools - Interaction Patterns - Conducting Usability Tests - Other Evaluative User Research Methods - Synthesizing Test Findings - Prototype Iteration

**UNIT V RESEARCH, DESIGNING, IDEATING, & INFORMATION ARCHITECTURE 9**

Identifying and Writing Problem Statements - Identifying Appropriate Research Methods - Creating Personas - Solution Ideation - Creating User Stories - Creating Scenarios - Flow Diagrams - Flow Mapping - Information Architecture

**TOTAL: 45 PERIODS**

## OUTCOMES

Upon completion of this course, Students will be able to:

- Explain problem statements to guide their design process
- Analyze and evaluate existing interfaces based on visual and UI principles, identifying strengths and areas for improvement
- Develop a comprehensive understanding of the key components that constitute User Experience
- Create Wireframe, Prototype and Testing
- Identify and write clear problem statements to address user needs effectively

## TEXT BOOKS

1. Joel Marsh, "UX for Beginners", O'Reilly , 2022
2. Jon Yablonski, "Laws of UX using Psychology to Design Better Product & Services", O'Reilly, 2021

## REFERENCES

1. Jenifer Tidwell, Charles Brewer, Aynne Valencia, "Designing Interface", 3 rd Edition , O'Reilly 2020
2. Steve Schoger, Adam Wathan "Refactoring UI", 2018

## E-RESOURCES

1. https://www.nngroup.com/articles/
2. https://www.interaction-design.org/literature

**SEMESTER V**

| | | |
|---|---|---|
| **19ADFT03** | **SOFTWARE TESTING AND AUTOMATION** | **L T P C**<br>**3 0 0 3** |

**OBJECTIVES**

- To understand the importance of software testing and its role in software development
- To learn how to do the testing and planning effectively
- To understand various factors influencing test design
- To learn different types of performance testing
- To study the concept of automated software testing and its benefits

**UNIT I FOUNDATIONS OF SOFTWARE TESTING 9**

Why do we test Software?, Black-Box Testing and White-Box Testing, Software Testing Life Cycle, V-model of Software Testing, Program Correctness and Verification, Reliability versus Safety, Failures, Errors and Faults (Defects), Software Testing Principles, Program Inspections, Stages of Testing: Unit Testing, Integration Testing, System Testing

**UNIT II TEST PLANNING 9**

The Goal of Test Planning, High Level Expectations,Intergroup Responsibilities, Test Phases, Test Strategy, Resource Requirements, Tester Assignments, Test Schedule, Test Cases, Bug Reporting, Metrics and Statistics.

**UNIT III TEST DESIGN AND EXECUTION 9**

Test Objective Identification, Test Design Factors, Requirement identification, Testable Requirements, Modeling a Test Design Process, Modeling Test Results, Boundary Value Testing, Equivalence Class Testing, Path Testing, Data Flow Testing, Test Design Preparedness Metrics, Test Case Design Effectiveness, Model-Driven Test Design, Test Procedures, Test Case Organization and Tracking, Bug Reporting, Bug Life Cycle.

**UNIT IV ADVANCED TESTING CONCEPTS 9**

Performance Testing: Load Testing, Stress Testing, Volume Testing, Fail-Over Testing, Recovery Testing, Configuration Testing, Compatibility Testing, Usability Testing, Testing the Documentation, Security testing, Testing in the Agile Environment, Testing Web and Mobile Applications.

**UNIT V TEST AUTOMATION AND TOOLS 9**

Automated Software Testing, Automate Testing of Web Applications, Selenium: Introducing Web Driver and Web Elements, Locating Web Elements, Actions on Web Elements, Different Web

Drivers, Understanding Web Driver Events, Testing: Understanding Testing.xml, Adding Classes, Packages, Methods to Test, Test Reports.

**TOTAL: 45 PERIODS**

**OUTCOMES**

Upon completion of this course, Students will be able to:

- Apply Black-Box and White-Box Testing techniques based on different testing scenarios
- Explain and understand the purpose and significance of test planning in software development
- Develop clear and concise test procedures and organize test cases for efficient execution
- Explain and conduct Load Testing, Stress Testing, Volume Testing, Fail-Over Testing, Recovery Testing, and Configuration Testing as per project requirements
- Demonstrate the advantages and use cases of test automation in software testing

**TEXT BOOKS**

1. Yogesh Singh, "Software Testing", Cambridge University Press, 2012.
2. Unmesh Gundecha, Satya Avasarala, "Selenium WebDriver 3 Practical Guide" - Second Edition 2018.

**REFERENCES**

1. Glenford J. Myers, Corey Sandler, Tom Badgett, "The Art of Software Testing", John Wiley & Sons, Inc, 3rd Edition, 2012.
2. Ron Patton, "Software testing", Sams Publishing, 2nd Edition, 2006.

**E-RESOURCES**

1. https://onlinecourses.nptel.ac.in/noc22_cs61/preview (Programming, Algorithms, Discrete Mathematics (basics))
2. https://onlinecourses.nptel.ac.in/noc23_cs38/preview (Basic Knowledge of Programming)

**SEMESTER VI**

| 19ADFE01 | CLOUD COMPUTING SERVICES | L T P C<br>3 0 2 4 |
|---|---|---|

**OBJECTIVES**

- To understand the principles of cloud architecture, models and infrastructure.
- To know the concepts of virtualization and virtual machines.
- To learn knowledge about virtualization Infrastructure
- To study and experiment with various Cloud deployment environments
- To learn about the security issues in the cloud environment
- To understand to monitor and manage cloud performance to ensure optimal service delivery and resource utilization

**UNIT I CLOUD ARCHITECTURE MODELS AND INFRASTRUCTURE 9**

Cloud Architecture: System Models for Distributed and Cloud Computing – NIST Cloud Computing Reference Architecture – Cloud deployment models – Cloud service models; Cloud Infrastructure: Architectural Design of Compute and Storage Clouds – Design Challenges

**UNIT II VIRTUALIZATION BASICS 9**

Virtual Machine Basics – Taxonomy of Virtual Machines – Hypervisor – Key Concepts – Virtualization structure – Implementation levels of virtualization – Virtualization Types: Full Virtualization – Para Virtualization – Hardware Virtualization – Virtualization of CPU, Memory and I/O devices.

**UNIT III VIRTUALIZATION INFRASTRUCTURE AND DOCKER 9**

Desktop Virtualization – Network Virtualization – Storage Virtualization – System-level of Operating Virtualization – Application Virtualization – Virtual clusters and Resource Management – Containers vs. Virtual Machines – Introduction to Docker – Docker Components – Docker Container – Docker Images and Repositories.

**UNIT IV CLOUD DEPLOYMENT ENVIRONMENT 9**

Google App Engine – Amazon AWS – Microsoft Azure; Cloud Software Environments – Eucalyptus – OpenStack.

**UNIT V CLOUD SECURITY 9**

Virtualization System-Specific Attacks: Guest hopping – VM migration attack – hyperjacking. Data Security and Storage; Identity and Access Management (IAM) - IAM Challenges - IAM Architecture and Practice.

**TOTAL: 45 PERIODS**

**LIST OF EXPERIMENTS**
**(ANY 7 EXPERIMENTS)**

1. Install Virtualbox/VMware/ Equivalent open source cloud Workstation with different flavours of Linux or Windows OS on top of windows 8 and above.
2. Install a C compiler in the virtual machine created using a virtual box and execute Simple Programs
3. Install Google App Engine. Create a hello world app and other simple web applications using python/java.
4. Use the GAE launcher to launch the web applications.
5. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.
6. Find a procedure to transfer the files from one virtual machine to another virtual machine.
7. Install Hadoop single node cluster and run simple applications like wordcount.
8. Creating and Executing Your First Container Using Docker.
9. Run a Container from Docker Hub

**OUTCOMES**

Upon completion of this course, Students will be able to:

- Explain different cloud architecture models for distributed and cloud computing
- Apply the concept of virtualization and its types.
- Experiment with virtualization of hardware resources and Docker.
- Develop and deploy services on the cloud and set up a cloud environment.
- Explain security challenges in the cloud environment.
- Classify how cloud computing is applied in various industries, from startups to enterprises, to streamline operations and support business growth

**TEXT BOOKS**

1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. James Turnbull, "The Docker Book", O'Reilly Publishers, 2014.

3. Krutz, R. L., Vines, R. D, "Cloud security. A Comprehensive Guide to Secure Cloud Computing", Wiley Publishing, 2010.

**REFERENCES**

1. James E. Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.
2. Tim Mather, Subra Kumaraswamy, and Shahed Latif, "Cloud Security and Privacy: an enterprise perspective on risks and compliance", O'Reilly Media, Inc., 2009.

**E-RESOURCES**

1. https://onlinecourses.nptel.ac.in/noc21_cs14/preview (Basics of Computer Architecture and Organization, Networking)
2. https://nptel.ac.in/courses/106105167 (Cloud Computing)

**SEMESTER VII**

| | | |
|---|---|---|
| **19ADFP01** | **PROJECT WORK** | **L T P C**<br>**0 0 12 6** |

**OBJECTIVES**

- To develop the student's learning and skill development in a specific area of interest
- To provide students with an opportunity to apply the theoretical knowledge gained from their minor courses to a practical real-world scenario or problem
- To learn and conduct research and investigate various aspects, fostering critical thinking and problem-solving skills.
- To promote collaboration and teamwork among students, enabling them to work effectively in a team environment
- To prepare project report and to face reviews and viva voce examination.

**GUIDELINES**

The student can select any topic which is relevant to his/her specialization of the programme. The student should continue the work on the selected topic as per the formulated methodology. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work, resultsand discussion, conclusion and references should be prepared as per the format prescribed by the University and submitted to the Head of the department. The students will be evaluatedbased on the report and viva-voce examination by a panel of examiners as per the Regulations.

**TOTAL: 15 PERIODS**

**OUTCOMES**

Upon completion of this course, Students will be able to:

- Demonstrate a sound technical knowledge of their selected project topic.
- Develop problem-solving skills as they analyze issues, design solutions, and implement them in their projects.
- Improve their communication and presentation abilities.
- Build successful collaboration and teamwork will be evident in the project's execution and outcomes
- Explain new knowledge or insights to the relevant field, making it a valuable addition to the academic community.

## CREDIT SUMMARY

## FOR B.E. / B.Tech. DEGREE PROGRAMMES

## MINOR DEGREE / HONOURS

## (FULL STACK DEVELOPMENT)

## B.Tech. ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

| Category | Semester | | | | | | | | Credit Total |
|---|---|---|---|---|---|---|---|---|---|
| | I | II | III | IV | V | VI | VII | VIII | |
| PC | - | - | 3 | 3 | 3 | 4 | - | - | 13 |
| EEC | - | - | - | - | - | - | 6 | - | 6 |
| Total | - | - | 3 | 3 | 3 | 4 | 6 | - | 19 |

# DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

# REGULATION-2019

# MINOR DEGREE/HONOURS

# BLOCKCHAIN

# CURRICULUM AND SYLLABI

# CURRICULUM AND SYLLABI

## FOR B.E. / B.Tech. DEGREE PROGRAMMES

## (MINOR / HONOURS DEGREE)

## BLOCKCHAIN

## B.Tech. – ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

| Course Code | Name of the Subject | Category | Periods / Week | | | Credit | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | C | CIA | ESE | TOT |
| **THEORY** | | | | | | | | | |
| 19ADBT01 | Fundamentals of Blockchain | PC | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 19ADBT02 | Blockchain Platforms and Use cases | PC | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 19ADBT03 | Blockchain Security and Performance | PC | 3 | 0 | 0 | 3 | 40 | 60 | 100 |
| 19ADBE01 | Smart Contracts and Solidity | PC | 3 | 0 | 2 | 4 | 50 | 50 | 100 |
| 19ADBP01 | Project Work | EEC | 0 | 0 | 10 | 6 | 40 | 60 | 100 |
| **Total Credits** | | | **19** | | | | | | |

PC : Professional Core
EEC : Employability Enhancement Courses
L : Lecture
T : Tutorial
P : Practical
C : Credit Point
CIA : Continuous Internal Assessment
ESE : End Semester Examination
TOT : Total

**SEMESTER - III**

**19ADBT01 FUNDAMENTALS OF BLOCKCHAIN L T P C**
**3 0 0 3**

**OBJECTIVES**

- To understand the fundamental concepts of blockchain technology.
- To understand the Bitcoin Blockchain model.
- To study and explore the Ethereum Blockchain, with a focus on Smart Contracts, Ethereum Structure, Operations, Consensus Model, and Incentive Model.
- To understand and learn about different types of blockchain.
- To understand the different types of consensus algorithms.

**UNIT I INTRODUCTION 9**

The Double-Spend Problem, Byzantine Generals' Computing Problems, PublicKey Cryptography, Hashing, Distributed Systems, Distributed Consensus.

**UNIT II TECHNOLOGY STACK AND BITCOIN BLOCKCHAIN 9**

Technology Stack: Blockchain, Protocol, Currency. Bitcoin Blockchain: Structure, Operations, Features, Consensus Model, Incentive Model.

**UNIT III ETHEREUM BLOCKCHAIN 9**

Ethereum Blockchain: Smart Contracts, Ethereum Structure, Operations, Consensus Model, Incentive Model.

**UNIT IV TIERS OF BLOCKCHAIN TECHNOLOGY 9**

Tiers of Blockchain Technology: Blockchain 1.0, Blockchain 2.0, Blockchain 3.0, Types of Blockchain: Public Blockchain, Private Blockchain, Semi-Private Blockchain, Sidechains.

**UNIT V TYPES OF CONSENSUS ALGORITHMS 9**

Types of Consensus Algorithms: Proof of Stake, Proof of Work, Delegated Proof of Stake, Proof Elapsed Time, Deposite-Based Consensus, Proof of Importance, Federated Consensus or Federated Byzantine Consensus, Practical Byzantine Fault Tolerance. Blockchain Use Case: Supply Chain Management.

**TOTAL : 45 PERIODS**

**OUTCOMES**

Upon completion of this course, Students will be able to:

- Demonstrate a clear understanding of the fundamental concepts and challenges addressed by blockchain technology.

- Explain the Technology Stack of blockchain systems and the roles of Blockchain, Protocol, and Currency layers in a blockchain ecosystem.
- Analyze the Ethereum Blockchain, with a focus on Smart Contracts, Ethereum Structure, Operations, Consensus Model, and Incentive Model.
- Differentiate between various tiers of blockchain technology and understand the unique characteristics of different types of blockchains.
- Compare and contrast various Consensus Algorithms used in blockchain networks.

**TEXT BOOKS**

1. Kirankalyan Kulkarni, Essentials of Bitcoin and Blockchain, Packt Publishing, 2018.
2. Anshul Kaushik, Block Chain & Crypto Currencies, Khanna Publishing House, 2018.

**REFERENCES**

1. Tiana Laurence, Blockchain for Dummies, 2nd Edition 2019, John Wiley & Sons.
2. Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks by Imran Bashir, Packt Publishing (2017).

**E-RESOURCES**

1. https://www.coursera.org/specializations/blockchain
2. https://nptel.ac.in/courses/106105184/
3. https://swayam.gov.in/nd1_noc20_cs01/preview

**SEMESTER IV**

| | | |
|---|---|---|
| **19ADBT02** | **BLOCKCHAIN PLATFORMS AND USE CASES** | **L T P C**<br>**3 0 0 3** |

**OBJECTIVES**

- To learn different types of blockchain platforms.
- To understand different types of Decentralized applications developed using blockchain technology.
- To learn and compare different blockchain platforms based on their consensus mechanisms, performance, scalability, security, and suitability for various use cases.
- To study a wide range of real-world use cases for blockchain technology.
- To understand several types of blockchain use cases.

**UNIT I PERMISSIONED BLOCKCHAINS 9**

Hyperledger Fabric Services, Model and Functions, Hyperledger Composer, Microsoft Azure Blockchain Platform and Services, Other Platforms: IOTA, TRON, Ziliqa, Cosmos, Ripple.

**UNIT II DECENTRALIZED APPLICATION PLATFORMS 9**

Augur-Decentralised Prediction Market Platform, Grid+-Energy Ecosystem Platform.

**UNIT III CHALLENGES AND SOLUTIONS RELATED TO BLOCKCHAIN 9**

Consensus, Scalability, Privacy and Confidentiality, Escrow, and Multi signature.

**UNIT IV INTERPLANETARY FILE SYSTEM 9**

Alternative Decentralized Solutions: Interplanetary File System (IPFS) Working and Uses, Hashgrapgh- Working, Benefits, And Use-Cases.

**UNIT V BLOCKCHAIN USE CASES 9**

Financial Services Related Use Cases, Revolutionization of Global Trade, Digital Identity, Auditing Services, Supply Chain Management, Healthcare Related Services, Blockchain and IOT, Blockchain and AI.

**TOTAL: 45 PERIODS**

**OUTCOMES**

Upon completion of this course, Students will be able to:

- Classify various blockchain platforms and their underlying technologies
- Explain the concept of the Grid+-Energy Ecosystem Platform and its decentralized nature for energy-related applications.
- Identify and analyze the challenges related to consensus mechanisms in blockchain networks and propose potential solutions

- Explain a clear understanding of the Interplanetary File System (IPFS) and its decentralized approach to file storage and sharing
- Assess the use of blockchain technology in various financial services applications, such as payment systems, remittances, and asset tokenization

**TEXT BOOKS**

1. Tiana Laurence, "Blockchain for Dummies", John Wiley & Sons Publisher, 2nd Edition 2019.
2. Anshul Kaushik, "Block Chain & Crypto Currencies", Khanna Publishing House, 2018.

**REFERENCES**

1. Narayan Prusty, "Building Blockchain Projects", Packt Publishing, 2017.
2. Imran Bashir, "Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks", Packt Publishing, 2017.

**E-RESOURCES**

1. https://nptel.ac.in/courses/106105184/
2. https://www.coursera.org/learn/blockchain-platforms

**SEMESTER V**

| | | |
|---|---|---|
| **19ADVT03** | **BLOCKCHAIN SECURITY AND PERFORMANCE** | **L T P C**<br>**3 0 0 3** |

**OBJECTIVES**

- To understand the various security issues associated with blockchain technology
- To learn different security tools for smart contracts
- To study performance-related challenges in blockchain networks
- To learn various performance improvement techniques
- To study different applications of blockchain technology

**UNIT I SECURITY ISSUES** **9**

Blockchain Related Issues, Higher-Level Language (Solidity) Related Issues, EVM Bytecode Related Issues, Real-Life Attacks on Blockchain Applications/ Smart Contracts, Trusted Execution Environments

**UNIT II SECURITY TOOLS FOR SMART CONTRACTS** **9**

Working, Advantages, And Disadvantages of Tools- Oyente, Securify, Maian, Manticore, Mythril, SmartCheck, Verx. Secure Key Management, Quantum Resilience Keys.

**UNIT III PERFORMANCE RELATED ISSUES** **9**

Transaction Speed, Transaction Fees, Network Size, Complexity, Interoperability Problems, Lack of Standardization. Lack of Supportive Regulations Related to Blockchain Applications

**UNIT IV PERFORMANCE IMPROVEMENTS** **9**

Off-Chain State Channels, Sidechains, Parallels Chains, Concurrent Smart Contract Transactions, Sharding Technique and Its Benefits, Atomic Swaps Between Smart Contracts.

**UNIT V BLOCKCHAIN APPLICATIONS** **9**

Decentralized Cryptocurrency, Distributed Cloud Storage, EVoting, Insurance Claims, Cross-Border Payments, Asset Management, Smart Appliances.

**TOTAL: 45 PERIODS**

**OUTCOMES**

Upon completion of this course, Students will be able to:

- Identify and evaluate security vulnerabilities and risks in blockchain applications and smart contracts
- Explain a thorough understanding of various security tools used for auditing and analyzing smart contracts

- Recognize the challenges related to interoperability and the lack of supportive regulations for blockchain applications
- Identify and apply performance improvement techniques to enhance the scalability and efficiency of blockchain systems
- Understand the potential benefits and limitations of implementing blockchain solutions in different real-world scenarios

**TEXT BOOKS**

1. Mastering Ethereum: Building Smart Contracts and Dapps Book by Andreas Antonopoulos and Gavin Wood, Shroff Publisher/O′Reilly Publisher.
2. "Blockchain and Healthcare: New Era of Digital Health Systems", Rajendra Akerkar, Natarajan Meghanathan, and Dhinaharan Nagamalai, Springer Publisher, 2019.

**REFERENCES**

1. "Blockchain Basics: A Non-Technical Introduction in 25 Steps", Daniel Drescher, Apress Publication, 2017.
2. "Blockchain for Business: A Hands-On Approach", Arshdeep Bahga and Vijay Madisetti, VPT Publisher, 2020.

**E-RESOURCES**

1. https://www.edx.org/course/blockchain-and-fintech-basics-applications-and-limitations
2. https://nptel.ac.in/courses/106105235

**SEMESTER VI**

**19ADVE01 SMART CONTRACTS AND SOLIDITY L T P C**
**3 0 2 4**

**OBJECTIVES**

- To understand the concept of smart contracts related to blockchain
- To understand the life cycle of a smart contract, from development to deployment and execution
- To learn the Solidity programming language
- To understand the Truffle framework and Ganache for smart contract development and deployment
- To learn how to create decentralized applications (DApps), which include both smart contracts and front-end user interfaces
- To understand the process of connecting a smart contract with the front-end application of a DApp

**UNIT I SMART CONTRACTS 9**

Definition and Need, Features of Smart Contracts, Life Cycle of a Smart Contract, Introduction to Ethereum Higher-Level Languages.

**UNIT II DEVELOPMENT ENVIRONMENT 9**

Building A Simple Smart Contract with Solidity, SolcCompiler, Ethereum Contract ABI, Remix-IDE for Smart Contract Development.

**UNIT III INTRODUCTION TO SOLIDITY 9**

Introduction to Solidity: Contracts, Constructors & Functions, Variables, Getters & Setters, Arrays, Memory vs Storage, Mappings in Solidity. Advanced Solidity: Structs, Error Handling & Restrictions, Libraries, Global Variables in Solidity, Abstract Contracts, Inheritance, And Interfaces, Events

**UNIT IV TRUFFLE FRAMEWORK & GANACHE 9**

Environment Setup for Truffle & Ganache, Truffle Project Creation, Truffle Compile, Migrate and Create Commands.

**UNIT V DECENTRALIZED APP CREATION 9**

Smart Contract Creation, Front-End Creation, Connecting Smart Contract with Front-End Application, Deploying Dapp, Validation, And Testing of Dapp.

**LIST OF EXPERIMENTS**
**(ANY 7 EXPERIMENTS)**

1. Create a simple Solidity smart contract that allows you to store and retrieve a "Hello, World!" message on the blockchain.
2. Develop a Solidity contract that accepts incoming transactions, stores sender information, and emits an event when a new transaction occurs.
3. Write a Solidity smart contract to create a basic ERC-20 token with functions for minting, transferring, and querying the token balance.
4. Design a crowdfunding smart contract where users can contribute funds, and the contract releases funds to the campaign creator when a predefined goal is reached.
5. Create a voting decentralized application (DApp) using Solidity, where users can cast their votes for a given proposal, and the contract calculates the winner.
6. Design a simple DAO using a Solidity smart contract, allowing members to vote on proposals for decision-making.
7. Implement a Solidity contract that locks funds for a specified duration and releases them only after a predetermined time.
8. Develop a Solidity contract that generates a random number using various methods like block hash and chainlink VRF.
9. Create a multi-signature wallet contract that requires multiple parties' approval for fund withdrawals.
10. Build a basic decentralized marketplace using Solidity, where users can list items for sale and other users can purchase them using cryptocurrency.

**TOTAL : 45 + 15 = 60 PERIODS**

**OUTCOMES**

Upon completion of this course, Students will be able to:

- Classify the life cycle of a smart contract, from its inception to execution and eventual termination.
- Create a simple smart contract using Solidity and the necessary tools like SolcCompiler and Remix-IDE
- Apply various data structures in Solidity, such as arrays and mappings, and differentiate between memory and storage usage
- Develop a Truffle project and learn how to use Truffle commands

- Design a complete decentralized application (DApp) by combining smart contract development with front-end creation
- Deploy the DApp on the Ethereum blockchain and perform thorough validation and testing to ensure its functionality and security

**TEXT BOOKS**

1. Tiana Laurence, "Blockchain for Dummies", John Wiley & Sons publisher, 2nd Edition 2019.
2. Anshul Kaushik, "Block Chain & Crypto Currencies", Khanna Publishing House , 2020.

**REFERENCES**

1. Narayan Prusty, "Building Blockchain Projects", Packt Publishing, 2017.
2. Andreas Antonopoulos and Gavin Wood, "Mastering Ethereum: Building Smart Contracts and Dapps", Shroff Publisher/O'Reilly Publisher, 2018.

**E-RESOURCES**

1. https://www.coursera.org/learn/smarter-contracts
2. https://www.udemy.com/course/solidity-smart-contracts-build-dapps-in-ethereum-blockchain/
3. https://swayam.gov.in/nd1_noc20_cs01/preview

**SEMESTER VII**

| | | |
|---|---|---|
| **19ADBP01** | **PROJECT WORK** | **L T P C**<br>**0 0 12 6** |

**OBJECTIVES**

- To develop the student's learning and skill development in a specific area of interest
- To provide students with an opportunity to apply the theoretical knowledge gained from their minor courses to a practical real-world scenario or problem
- To learn and conduct research and investigate various aspects, fostering critical thinking and problem-solving skills.
- To promote collaboration and teamwork among students, enabling them to work effectively in a team environment
- To prepare project report and to face reviews and viva voce examination.

**GUIDELINES FOR REVIEW AND EVALUATION**

The student can select any topic which is relevant to his/her specialization of the programme. The student should continue the work on the selected topic as per the formulated methodology. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work, results and discussion, conclusion and references should be prepared as per the format prescribed by the University and submitted to the Head of the department. The students will be evaluated based on the report and viva-voce examination by a panel of examiners as per the Regulations.

**TOTAL: 15 PERIODS**

**OUTCOMES**

Upon completion of this course, Students will be able to:

- Demonstrate a sound technical knowledge of their selected project topic.
- Develop problem-solving skills as they analyze issues, design solutions, and implement them in their projects.
- Improve their communication and presentation abilities.
- Build successful collaboration and teamwork will be evident in the project's execution and outcomes
- Explain new knowledge or insights to the relevant field, making it a valuable addition to the academic community.

## CREDIT SUMMARY

## FOR B.E. / B.Tech. DEGREE PROGRAMMES

## MINOR DEGREE / HONOURS

## (BLOCKCHAIN)

## B.Tech. ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

| Category | Semester | | | | | | | | Credit Total |
|---|---|---|---|---|---|---|---|---|---|
| | I | II | III | IV | V | VI | VII | VIII | |
| PC | - | - | 3 | 3 | 3 | 4 | - | - | 13 |
| EEC | - | - | - | - | - | - | 6 | - | 6 |
| Total | - | - | 3 | 3 | 3 | 4 | 6 | - | 19 |