



Sri

SAI RAM

INSTITUTE OF TECHNOLOGY

An Autonomous Institution

West Tambaram, Chennai - 44

www.sairamit.edu.in

Approved by AICTE, New Delhi
Affiliated to Anna University



DEPARTMENT OF
**COMPUTER & COMMUNICATION
ENGINEERING**

REGULATIONS
2020

Academic Year 2020-21 onwards

AUTONOMOUS
CURRICULUM AND

SYLLABUS
I - VIII
SEMESTERS

SRI SAIRAM INSTITUTE OF TECHNOLOGY



VISION

To be identified as a "Centre of Excellence" with high standards of Knowledge Dissemination and Research opportunities and to transform the students to imbibe qualities of technical expertise of international standards and high levels of ethical values, who in turn shall contribute to the advancement of society and human kind.



MISSION

We shall dedicate and commit ourselves to attain and maintain excellence in Technical Education through commitment and continuous improvement of infrastructure and equipment and provide an inspiring environment for Learning, Research and Innovation for our students to transform them into complete human beings with ethical and social values.



QUALITY POLICY

We at Sri Sai Ram Institute of Technology are committed to build a better nation through Quality Education with team spirit. Our students are enabled to excel in all values of Life and become Good Citizens. We continually improve the System, Infrastructure and Services to satisfy the Students, Parents, Industry and Society.

DEPARTMENT OF COMPUTER AND COMMUNICATION ENGINEERING



VISION

To produce globally competent and socially responsible engineers who can address the engineering challenges and excel at an international level, in the advancement of Computer and Communication Engineering through research and academia.



MISSION

- M1 To provide a good environment with latest technological infrastructure facilities, teaching-learning ambience and interaction with industry in the area of Computer and Communication Engineering .
- M2 To inculcate graduates with high social responsibility, right attitude, discipline and an inclination towards offering their professional expertise in serving the society.

AUTONOMOUS CURRICULA AND SYLLABI Regulations 2020

SEMESTER I

| S. NO | COURSE CODE | COURSE TITLE | WEEK HOURS | | | TOTAL CONTACT HOURS | CREDITS |
|----------------------------|-------------|--------------------------------------|------------|---|---|---------------------|-----------|
| | | | L | T | P | | |
| THEORY | | | | | | | |
| 1 | 20BSMA101 | Engineering Mathematics-I | 3 | 1 | 0 | 4 | 4 |
| 2 | 20HSEN101 | Technical English-I | 3 | 0 | 0 | 3 | 3 |
| 3 | 20BSPH101 | Engineering Physics | 3 | 0 | 0 | 3 | 3 |
| 4 | 20BSCY101 | Engineering Chemistry | 3 | 0 | 0 | 3 | 3 |
| 5 | 20ESCS101 | Problem solving and Programming in C | 3 | 0 | 0 | 3 | 3 |
| 6 | 20ESGE101 | Engineering Graphics | 1 | 2 | 0 | 3 | 3 |
| PRACTICAL | | | | | | | |
| 7 | 20BSPL101 | Physics and Chemistry Laboratory | 0 | 0 | 3 | 3 | 1.5 |
| 8 | 20ESPL101 | Programming in C Laboratory | 0 | 0 | 3 | 3 | 1.5 |
| VALUE ADDITIONS - I | | | | | | | |
| 9 | 20TPHS101 | Skill Enhancement | 0 | 0 | 2 | 2 | 1 |
| 10 | 20HSMG101 | Personal Values | 2 | 0 | 0 | 2 | 0 |
| TOTAL | | | | | | 29 | 23 |

SEMESTER II

| S. NO | COURSE CODE | COURSE TITLE | WEEK HOURS | | | TOTAL CONTACT HOURS | CREDITS |
|-----------------------------|-------------|---------------------------------------|------------|---|---|---------------------|-----------|
| | | | L | T | P | | |
| THEORY | | | | | | | |
| 1 | 20BSMA201 | Engineering Mathematics -II | 3 | 1 | 0 | 4 | 4 |
| 2 | 20HSEN201 | Technical English - II | 3 | 0 | 0 | 3 | 3 |
| 3 | 20ESIT201 | Python Programming with lab | 3 | 0 | 2 | 5 | 4 |
| 4 | 20BSPH201 | Physics of Electronic Devices | 3 | 0 | 0 | 3 | 3 |
| 4 | 20BSCY201 | Environmental Science and Engineering | 3 | 0 | 0 | 3 | 3 |
| PRACTICAL | | | | | | | |
| 6 | 20ESGE201 | Engineering Practices Laboratory | 0 | 0 | 3 | 3 | 1.5 |
| 7 | 20ECPL201 | Circuits and Devices Laboratory | 0 | 0 | 3 | 3 | 1.5 |
| 8 | 20ECTE201 | PCB Design | 0 | 0 | 2 | 2 | 1 |
| VALUE ADDITIONS - II | | | | | | | |
| 9 | 20TPHS201 | Skill Enhancement | 0 | 0 | 2 | 2 | 1 |
| 10 | 20HSMG201 | Interpersonal Values | 2 | 0 | 0 | 2 | 0 |
| TOTAL | | | | | | 30 | 22 |

SEMESTER III

| S. NO | COURSE CODE | COURSE TITLE | WEEK HOURS | | | TOTAL CONTACT HOURS | CREDITS |
|------------------------------|-------------|--------------------------------------|------------|---|---|---------------------|-----------|
| | | | L | T | P | | |
| THEORY | | | | | | | |
| 1 | 20ITPC301 | Data Structures | 3 | 0 | 0 | 3 | 3 |
| 2 | 20CCPC301 | Digital logics and system design | 3 | 0 | 0 | 3 | 3 |
| 3 | 20ECPC303 | Signals and Systems | 3 | 1 | 0 | 4 | 4 |
| 4 | 20ITPC303 | Computer Organization & Architecture | 3 | 0 | 0 | 3 | 3 |
| 5 | 20BSMA301 | Linear Algebra, PDE and Transforms | 3 | 1 | 0 | 4 | 4 |
| PRACTICAL | | | | | | | |
| 6 | 20ITPL301 | Data Structures Laboratory | 0 | 0 | 3 | 3 | 1.5 |
| 7 | 20CCPL301 | Digital Circuits Laboratory | 0 | 0 | 3 | 3 | 1.5 |
| 8 | 20CCTE301 | Live-in-Lab - 1 | 0 | 0 | 2 | 2 | 1 |
| VALUE ADDITIONS - III | | | | | | | |
| 9 | 20CCTP301 | Skill Enhancement | 0 | 0 | 2 | 2 | 1 |
| 10 | 20MGMC301 | Constitution of India | 2 | 0 | 0 | 2 | 0 |
| TOTAL | | | | | | 29 | 22 |

SEMESTER IV

| S. NO | COURSE CODE | COURSE TITLE | WEEK HOURS | | | TOTAL CONTACT HOURS | CREDITS |
|-----------------------------|-------------|---|------------|---|---|---------------------|-----------|
| | | | L | T | P | | |
| THEORY | | | | | | | |
| 1 | 20CCPC401 | Analog and Digital Communication | 3 | 0 | 0 | 3 | 3 |
| 2 | 20CSPC402 | Data Base Management system | 3 | 0 | 0 | 3 | 3 |
| 3 | 20CCPW401 | Operating Systems with Lab | 3 | 0 | 2 | 5 | 4 |
| 4 | 20ECPC302 | Electromagnetic Fields and Waveguides | 3 | 1 | 0 | 4 | 4 |
| 5 | 20BSMA401 | Probability Theory & Stochastic Processes | 3 | 1 | 0 | 4 | 4 |
| PRACTICAL | | | | | | | |
| 6 | 20CCPL401 | Communication System Lab | 0 | 0 | 3 | 3 | 1.5 |
| 7 | 20CSPL402 | Database Management Systems Laboratory | 0 | 0 | 3 | 3 | 1.5 |
| 8 | 20CCTE401 | Live-in-Lab -II | 0 | 0 | 2 | 2 | 1 |
| VALUE ADDITIONS - IV | | | | | | | |
| 9 | 20CCTP401 | Skill Enhancement | 0 | 0 | 2 | 2 | 1 |
| TOTAL | | | | | | 29 | 23 |

SEMESTER V

| S. NO | COURSE CODE | COURSE TITLE | WEEK HOURS | | | TOTAL CONTACT HOURS | CREDITS |
|----------------------------|-------------|--|------------|---|---|---------------------|-----------|
| | | | L | T | P | | |
| THEORY | | | | | | | |
| 1 | 20CSPC301 | Object Oriented Programming | 3 | 0 | 0 | 3 | 3 |
| 2 | 20ECPC402 | Microcontrollers & Embedded systems | 3 | 0 | 0 | 3 | 3 |
| 3 | 20CSPW401 | Computer Networks (with Lab) | 3 | 0 | 0 | 3 | 3 |
| 4 | 20XXELXXX | Professional Elective-1 | 3 | 0 | 0 | 3 | 3 |
| 5 | 20XXOEXXX | Open Elective-1 | 3 | 0 | 0 | 3 | 3 |
| PRACTICAL | | | | | | | |
| 6 | 20ECPL401 | Microcontrollers & Embedded Systems Laboratory | 0 | 0 | 3 | 3 | 1.5 |
| 7 | 20CSPL301 | Object Oriented Programming Lab | 0 | 0 | 3 | 3 | 1.5 |
| 8 | 20CCTE501 | Live-in-Lab III | 0 | 0 | 4 | 4 | 2 |
| VALUE ADDITIONS - V | | | | | | | |
| 9 | 20CCTP501 | Skill Enhancement | 0 | 0 | 2 | 2 | 1 |
| TOTAL | | | | | | 29 | 22 |

SEMESTER VI

| S. NO | COURSE CODE | COURSE TITLE | WEEK HOURS | | | TOTAL CONTACT HOURS | CREDITS |
|-----------------------------|-------------|--|------------|---|---|---------------------|-------------|
| | | | L | T | P | | |
| THEORY | | | | | | | |
| 1 | 20ECPW501 | Discrete Time Signal Processing (with Lab) | 3 | 0 | 2 | 5 | 4 |
| 2 | 20CSPC403 | Object oriented Software Engineering | 3 | 0 | 0 | 3 | 3 |
| 3 | 20CSPC601 | Artificial Intelligence | 3 | 0 | 0 | 3 | 3 |
| 4 | 20CCPW601 | Wireless Communication & Computing with Laboratory | 3 | 0 | 2 | 5 | 4 |
| 5 | 20XXELXXX | Professional Elective-2 | 3 | 0 | 0 | 3 | 3 |
| 6 | 20XXOEXXX | Open Elective-2 | 3 | 0 | 0 | 3 | 3 |
| PRACTICAL | | | | | | | |
| 7 | 20HSPL501 | Communication and Soft Skills Lab | 0 | 0 | 2 | 2 | 1 |
| 8 | 20CSPL601 | Artificial Intelligence laboratory | 0 | 0 | 3 | 3 | 1.5 |
| 9 | 20CCPJ601 | Innovative Design Project | 0 | 0 | 2 | 2 | 1 |
| VALUE ADDITIONS - VI | | | | | | | |
| 10 | 20CCTP601 | Skill Enhancement | 0 | 0 | 2 | 2 | 1 |
| TOTAL | | | | | | 31 | 23.5 |

SEMESTER VII

| S. NO | COURSE CODE | COURSE TITLE | WEEK HOURS | | | TOTAL CONTACT HOURS | CREDITS |
|------------------------------|-------------|---|------------|---|---|---------------------|-------------|
| | | | L | T | P | | |
| THEORY | | | | | | | |
| 1 | 20CCPW701 | Cryptography & Network security with Laboratory | 3 | 0 | 2 | 5 | 4 |
| 2 | 20CSPC603 | Big Data Analytics | 3 | 0 | 0 | 3 | 3 |
| 3 | 20ITPC601 | Cloud computing and Virtualization | 3 | 0 | 0 | 3 | 3 |
| 4 | 20CCPC601 | Mobile Communication | 3 | 0 | 0 | 3 | 3 |
| 5 | 20XXELXXX | Professional Elective-3 | 3 | 0 | 0 | 3 | 3 |
| 6 | 20HSMG601 | Principles of Engineering Management | 3 | 0 | 0 | 3 | 3 |
| PRACTICAL | | | | | | | |
| 7 | 20CCPL701 | Big Data Analytics Laboratory | 0 | 0 | 3 | 3 | 1.5 |
| 8 | 20CCPJ701 | Project Phase -1 | 0 | 0 | 4 | 4 | 2 |
| VALUE ADDITIONS - VII | | | | | | | |
| 9 | 20CCTP701 | Skill Enhancement | 0 | 0 | 2 | 2 | 1 |
| TOTAL | | | | | | 29 | 23.5 |

SEMESTER VIII

| S. NO | COURSE CODE | COURSE TITLE | WEEK HOURS | | | TOTAL CONTACT HOURS | CREDITS |
|------------------|-------------|---------------------------|------------|---|---|---------------------|----------|
| | | | L | T | P | | |
| THEORY | | | | | | | |
| 1 | 20XXELXXX | Professional Elective - 4 | 3 | 0 | 0 | 3 | 3 |
| PRACTICAL | | | | | | | |
| 2 | 20CCPJ801 | Project Phase - II | 0 | 0 | 8 | 8 | 4 |
| TOTAL | | | | | | 11 | 7 |

CREDIT DISTRIBUTION

| Category | BS | ES | HS | EL | PC+PL | PW | OE | TE | PJ | TP | IS | MC | TOTAL |
|-------------------|------|-----|-----|-----|-------|------|-----|-----|-----|-----|-----|----|-------|
| Credit | 29.5 | 13 | 10 | 12 | 57.5 | 20 | 6 | 5 | 7 | 7 | 3 | Y | 170 |
| Percentage | 17.3 | 7.6 | 5.8 | 7.0 | 33.8 | 11.7 | 3.5 | 2.9 | 4.1 | 4.1 | 1.7 | - | |

*IS-Internship

PROFESSIONAL ELECTIVES - I

| S. NO | COURSE CODE | COURSE TITLE | WEEK HOURS | | | TOTAL CONTACT HOURS | CREDIT | STREAM |
|-------|-------------|---|------------|---|---|---------------------|--------|-----------------------------|
| | | | L | T | P | | | |
| 1 | 20CSPC501 | Internet Programming | 3 | 0 | 0 | 3 | 3 | Web Development |
| 2 | 20CSEL501 | Data Warehousing and Data Mining | 3 | 0 | 0 | 3 | 3 | Data Mining |
| 3 | 20CCEL503 | Embedded Real Time Systems | 3 | 3 | 0 | 0 | 3 | Embedded |
| 4 | 20CCEL504 | System on chip Architecture | 3 | 0 | 0 | 3 | 3 | Embedded |
| 5 | 20MGEL505 | Foundation skills in Integrated product Development | 3 | 0 | 0 | 3 | 3 | Product Development |
| 6 | 20CSEL607 | Agile Methodologies | 3 | 0 | 0 | 3 | 3 | Software Engineering |
| 7 | 20CCEL507 | Computational Linguistics | 3 | 3 | 0 | 0 | 3 | Natural Language Processing |
| 8 | 20CCEL508 | Distributed Database | 3 | 3 | 0 | 0 | 3 | Data Base |
| 9 | 20ECEL709 | Digital image processing | 3 | 3 | 0 | 0 | 3 | Image Processing |
| 10 | 20CCEL510 | Sensor Networks and IOT | 3 | 3 | 0 | 0 | 3 | Wireless Network |

PROFESSIONAL ELECTIVES - II

| S. NO | COURSE CODE | COURSE TITLE | WEEK HOURS | | | TOTAL CONTACT HOURS | CREDIT | STREAM |
|-------|-------------|---------------------------------------|------------|---|---|---------------------|--------|----------------------|
| | | | L | T | P | | | |
| 1 | 20CCEL601 | Wireless Sensor Networks | 3 | 0 | 0 | 3 | 3 | Wireless |
| 2 | 20ECEL701 | Cognitive Radio | 3 | 0 | 0 | 3 | 3 | Wireless |
| 3 | 20CCEL602 | Networking Engineering and Management | 3 | 0 | 0 | 3 | 3 | Network |
| 4 | 20ECEL502 | Industrial IOT | 3 | 0 | 0 | 3 | 3 | IoT |
| 5 | 20CSEL704 | Natural Language Processing | 3 | 0 | 0 | 3 | 3 | NLP |
| 6 | 20MGEL601 | Total Quality Management | 3 | 0 | 0 | 3 | 3 | Management |
| 7 | 20CCEL603 | Advanced Data Structures & Algorithms | 3 | 0 | 0 | 3 | 3 | Data Structure |
| 8 | 20ITEL608 | Software Testing | 3 | 0 | 0 | 3 | 3 | Software Engineering |
| 9 | 20CCEL604 | Infometrics | 3 | 0 | 0 | 3 | 3 | Data Mining |
| 10 | 20CSEL702 | Software Defined Networks | 3 | 0 | 0 | 3 | 3 | Network |

PROFESSIONAL ELECTIVES - III

| S. NO | COURSE CODE | COURSE TITLE | WEEK HOURS | | | TOTAL CONTACT HOURS | CREDIT | STREAM |
|-------|-------------|------------------------------------|------------|---|---|---------------------|--------|-----------------|
| | | | L | T | P | | | |
| 1 | 20CCEL701 | Adhoc Sensor Networks | 3 | 0 | 0 | 3 | 3 | Sensor Networks |
| 2 | 20CCEL702 | Human Computer Interaction | 3 | 0 | 0 | 3 | 3 | User Interface |
| 3 | 20CCEL703 | Quantum Computing | 3 | 0 | 0 | 3 | 3 | Cloud |
| 4 | 20EPC702 | Optical Communication | 3 | 0 | 0 | 3 | 3 | Wireless |
| 5 | 20CCEL704 | Data Base security and privacy | 3 | 0 | 0 | 3 | 3 | Security |
| 6 | 20CCEL705 | Parallel Architecture & Algorithms | 3 | 0 | 0 | 3 | 3 | Cloud |
| 7 | 20CSPC602 | Compiler Design | 3 | 0 | 0 | 3 | 3 | Compiler |
| 8 | 20ITEL710 | Service oriented Architecture | 3 | 0 | 0 | 3 | 3 | Cloud |
| 9 | 20CCEL706 | Advanced Wireless Communication | 3 | 0 | 0 | 3 | 3 | Wireless |
| 10 | 20CCEL707 | Principles of Multimedia | 3 | 0 | 0 | 3 | 3 | Multimedia |

PROFESSIONAL ELECTIVES - IV

| S. NO | COURSE CODE | COURSE TITLE | WEEK HOURS | | | TOTAL CONTACT HOURS | CREDIT | STREAM |
|-------|-------------|--|------------|---|---|---------------------|--------|-------------------------|
| | | | L | T | P | | | |
| 1 | 20CCEL801 | Hardware Software Codesign | 3 | 0 | 0 | 3 | 3 | Design |
| 2 | 20CCEL802 | Fuzzy Logic & Neural Networks | 3 | 0 | 0 | 3 | 3 | Fuzzy Logic |
| 3 | 20CSPC702 | Machine Learning Techniques | 3 | 0 | 0 | 3 | 3 | Machine Learning |
| 4 | 20ECEL803 | Satellite Communication | 3 | 0 | 0 | 3 | 3 | Wireless |
| 5 | 20CCEL803 | Ethical Hacking and Digital Forensics | 3 | 0 | 0 | 3 | 3 | Ethical Hacking |
| 6 | 20HSMG301 | Professional Ethics & Values | 3 | 0 | 0 | 3 | 3 | Management |
| 7 | 20CCEL804 | Database Tuning | 3 | 0 | 0 | 3 | 3 | Database |
| 8 | 20CCEL805 | Android Application Development | 3 | 0 | 0 | 3 | 3 | Mobile Development |
| 9 | 20CSEL706 | Multi-core Architectures & Programming | 3 | 0 | 0 | 3 | 3 | Parallel Processing |
| 10 | 20CSEL806 | Cognitive Science | 3 | 0 | 0 | 3 | 3 | Artificial Intelligence |

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

- PEO 1** Impart strong foundation in basic sciences, mathematics and engineering fundamentals, knowledge and capability.
- PEO2** Apply design principles and best practices for developing quality products for scientific and business applications.
- PEO 3** Inculcate high professionalism among the students by providing technical and soft skills with ethical standards.
- PEO 4** Promote collaborative learning and spirit of team work through multidisciplinary projects and diverse professional activities.
- PEO 5** Indoctrinate an attitude in the graduates for life- long learning process.

PROGRAM SPECIFIC OUTCOMES (PSOs)

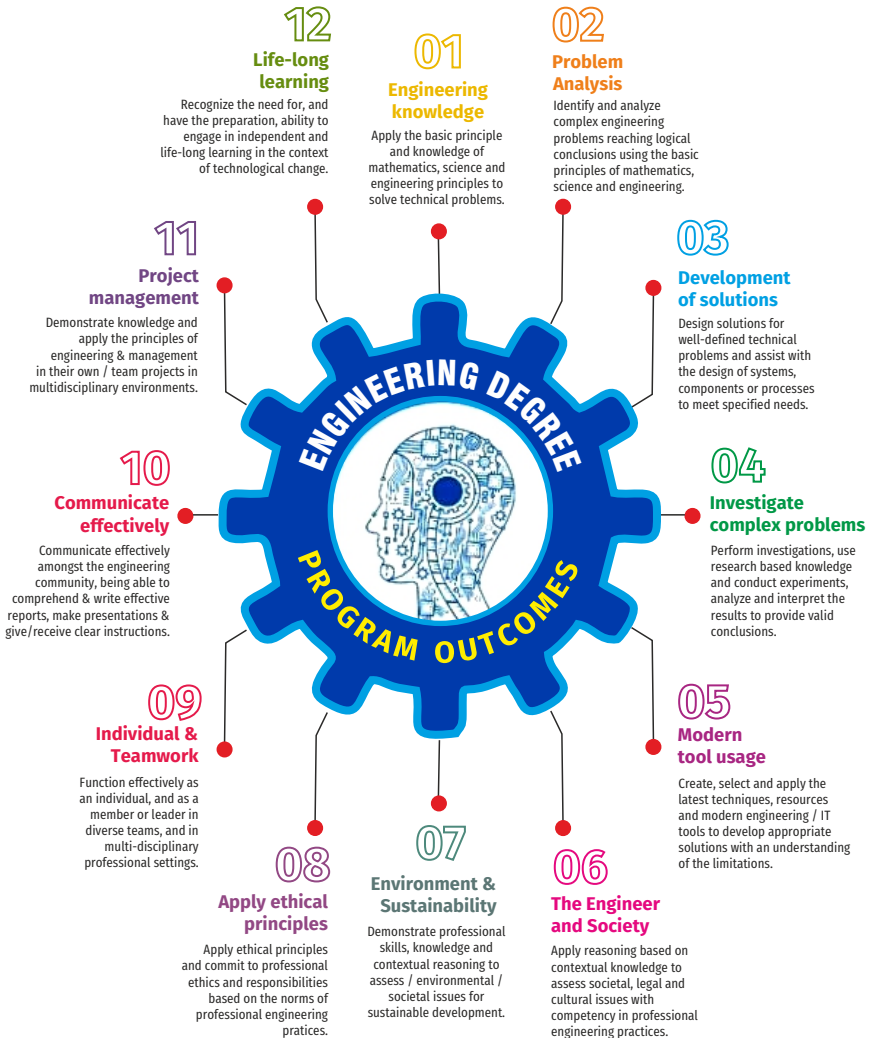
- PSO 1** Apply appropriate technology for the implementation of modern communication systems
- PSO2** Develop quality software for scientific and business applications by applying software engineering principles and practices .

COMPONENTS OF THE CURRICULUM (COC)

| Course Component | Curriculum Content (% of total number of credits of the program) | Total number of contact hours | Total Number of credits |
|-------------------------------------|--|-------------------------------------|----------------------------|
| Basic Sciences(BS) | 17.3 | 31 | 29.5 |
| Engineering Sciences(ES) | 7.6 | 17 | 13 |
| Humanities and Social Sciences (HS) | 5.8 | 15 | 10 |
| Professional Electives(EL) | 7.0 | 12 | 12 |
| Program Core+Program Lab (PC+PL) | 33.8 | 71 | 57.5 |
| Program theory with Lab (PW) | 11.7 | 20 | 20 |
| Open Electives (OE) | 3.5 | 06 | 6 |
| Talent Enhancement (TE) | 2.9 | 10 | 5 |
| Project (PJ) | 4.1 | 14 | 7 |
| Training & Placement (TP) | 4.1 | 14 | 7 |
| Internships/Seminars (IS) | 1.7 | - | 3 |
| Mandatory Courses (MC) | NA | 02 | NA |
| Total number of Credits | | 217 | 170 |

PROGRAMME OUTCOMES(POs)

PROGRAM OUTCOME REPRESENTS THE KNOWLEDGE, SKILLS AND ATTITUDES THAT THE STUDENTS WOULD BE EXPECTED TO HAVE AT THE END OF THE 4 YEAR ENGINEERING DEGREE PROGRAM



SEMESTER - I

| | | | | | |
|----------------------------|---------------------------|---|---|---|---|
| 20BSMA101 SDG NO. 4 & 9 | ENGINEERING MATHEMATICS-I | L | T | P | C |
| | | 3 | 1 | 0 | 4 |

OBJECTIVES:

The intent of this course is

- The intent of the course is to understand, gain the knowledge of matrix algebra.
- To introduce the concepts of limits, continuity, derivatives and maxima and minima.
- To acquaint the concept of improper integrals and the properties of definite integrals.
- To provide understanding of double integration, triple integration and their application.
- To introduce the concept of sequence and series and impart the knowledge of Fourier series.

UNIT I MATRICES

12

Symmetric, skew symmetric and orthogonal matrices; Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigenvalues and Eigenvectors – Cayley-Hamilton theorem(excluding proof) – Reduction of a Quadratic form to Canonical form using Orthogonal Transformation - Nature of Quadratic forms.

UNIT II DIFFERENTIAL CALCULUS

12

Limit, continuity, Differentiation rules - Maxima and Minima of functions of one variable, partial derivatives, Taylor's series for functions of two variables, Jacobian, Maxima & Minima of functions of several variables, saddle points, Method of Lagrange multipliers.

UNIT III INTEGRAL CALCULUS

12

Evaluation of definite and improper integral - Techniques of Integration-Substitution rule - Integration by parts, Integration of rational functions by partial fraction, Integration of irrational functions - Applications of definite integrals to evaluate surface areas and volumes of revolution.

UNIT IV MULTIPLE INTEGRALS

12

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.

UNIT V SEQUENCES AND SERIES**12**

Introduction to sequences and series – power series – Taylor's series – series for exponential, trigonometric, logarithmic, hyperbolic functions – Fourier series – Half range Sine and Cosine series – Parseval's theorem.

TOTAL: 60 PERIODS**TEXTBOOKS:**

1. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7th Edition, New Delhi, 2015.
2. B. V. Ramana, "Higher Engineering Mathematics", Tata McGraw-Hill, New Delhi, 11th Reprint, 2010.

REFERENCES:

1. G.B. Thomas and R.L. Finney, "Calculus and Analytic Geometry", 9th Edition, Pearson, Reprint, 2002.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley & Sons, 2006.
3. T. Veerarajan, "Engineering Mathematics for first year", Tata McGraw-Hill, New Delhi, 2008.
4. N.P. Bali and Manish Goyal, "A text-book of Engineering Mathematics", Laxmi Publications, Reprint, 2008.
5. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 40th Edition, 2014.

WEB REFERENCES:

1. <https://math.mit.edu/~gs/linearalgebra/ila0601.pdf>
2. <http://ocw.mit.edu/ans7870/18/18.013a/textbook/HTML/chapter30/>
3. <https://ocw.mit.edu/courses/mathematics/18-02sc-multivariable-calculus-fall-2010/2.-partial-derivatives/>
4. <http://ocw.mit.edu/ans7870/18/18.013a/textbook/HTML/chapter31/>

ONLINE RESOURCES:

1. <https://www.khanacademy.org/math/linear-algebra/alternate-bases/eigen-everything/v/linear-algebra-introduction-to-eigenvalues-and-eigenvectors>
2. <https://www.khanacademy.org/math/differential-calculus>

OUTCOMES:

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

1. Understand the concepts of symmetric, skew symmetric, orthogonal matrices, properties of Eigen values and eigen vectors, the nature of a quadratic form, sequences and series, power series representation of

functions, series representation of exponential, trigonometric logarithmic and hyperbolic functions. (K2)

2. Compute the eigen values, eigen vectors of a matrix, diagonalize the quadratic form using orthogonal transformation and find the inverse and higher powers of a matrix using Cayley Hamilton theorem. (K3)
3. Calculate the limit, derivative, partial derivatives, Jacobians of simple functions and evaluate integrals of single variable using the rules of integration. (K3)
4. Determine the Taylor series representation of functions of one variable and two variables and evaluate maxima and minima of functions of one variable, two variables and several variables. (K3)
5. Evaluate double integrals using change of order technique, double and triple integrals using change of variables technique and calculate surface areas and volume of solids of revolution. (K3)
6. Compute the Fourier series, Sine and Cosine series representation of functions defined in a period and use Fourier series and Parseval's theorem to find the value of infinite series. (K3)

CO - PO MAPPING :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | 3 | 3 | 2 | 1 | - | - | - | - | - | - | - | 1 |
| CO2 | 3 | 3 | 2 | 1 | - | - | - | - | - | - | - | 1 |
| CO3 | 3 | 3 | 2 | 1 | - | - | - | - | - | - | - | 1 |
| CO4 | 3 | 3 | 2 | 1 | - | - | - | - | - | - | - | 1 |
| CO5 | 3 | 3 | 2 | 1 | - | - | - | - | - | - | - | 1 |
| CO6 | 3 | 3 | 2 | 1 | - | - | - | - | - | - | - | 1 |

SEMESTER - I

| | | | | | |
|------------------------|-----------------------|---|---|---|---|
| 20HSEN101 SDG NO. 4 | TECHNICAL ENGLISH - I | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To develop the basic LSRW skills of the students
- To encourage the learners to adapt to listening techniques
- To help learners develop their communication skills and converse fluently in real contexts

- To help learners develop general and technical vocabulary through reading and writing tasks
- To improve the language proficiency for better understanding of core subjects

UNIT I INTRODUCTION

9

Listening – short texts – formal and informal conversations - **Speaking** – basics in speaking – speaking on given topics & situations – recording speeches and strategies to improve - **Reading** – critical reading – finding key information in a given text – shifting facts from opinions - **Writing** – free writing on any given topic – autobiographical writing - **Language Development** – tenses – voices- word formation: prefixes and suffixes – parts of speech – developing hints

UNIT II READING AND LANGUAGE DEVELOPMENT

9

Listening - long texts - TED talks - extensive speech on current affairs and discussions - **Speaking** – describing a simple process – asking and answering questions - **Reading** comprehension – skimming / scanning / predicting & analytical reading – question & answers – objective and descriptive answers – identifying synonyms and antonyms - process description - **Writing** instructions – **Language Development** – writing definitions – compound words - articles – prepositions

UNIT III SPEAKING AND INTERPRETATION SKILLS

9

Listening - dialogues & conversations - **Speaking** – role plays – asking about routine actions and expressing opinions - **Reading** longer texts & making a critical analysis of the given text - **Writing** – types of paragraph and writing essays – rearrangement of jumbled sentences - writing recommendations - **Language Development** – use of sequence words - cause & effect expressions - sentences expressing purpose - picture based and newspaper based activities – single word substitutes

UNIT IV VOCABULARY BUILDING AND WRITING SKILLS

9

Listening - debates and discussions – practicing multiple tasks – self introduction – **Speaking** about friends/places/hobbies - **Reading** - Making inference from the reading passage – Predicting the content of the reading passage - **Writing** – informal letters/e-mails - **Language Development** - synonyms & antonyms - conditionals – if, unless, in case, when and others – framing questions.

UNIT V LANGUAGE DEVELOPMENT AND TECHNICAL WRITING

9

Listening - popular speeches and presentations - **Speaking** - impromptu

speeches & debates - **Reading** - articles – magazines/newspapers **Writing** – essay writing on technical topics - channel conversion – bar diagram/ graph – picture interpretation - process description - **Language Development** – modal verbs - fixed / semi-fixed expressions – collocations

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Board of Editors. Using English: A Coursebook for Undergraduate Engineers and Technologists. Orient Blackswan Limited, Hyderabad: 2015.
2. Dhanavel, S.P. English and Communication Skills for Students of Science and Engineering. Orient Blackswan, Chennai, 2011.

REFERENCES:

1. Anderson, Paul V. Technical Communication: A Reader – Centered Approach. Cengage, New Delhi, 2008.
2. Smith-Worthington, Darlene & Sue Jefferson. Technical Writing for Success. Cengage, Mason, USA, 2007.
3. Grussendorf, Marion, English for Presentations, Oxford University Press, Oxford, 2007.
4. Chauhan, Gajendra Singh and et.al. Technical Communication (Latest Revised Edition). Cengage Learning India Pvt. Limited, 2018.

WEB REFERENCES:

1. https://swayam.gov.in/nd1_noc19_hs31/preview
2. <http://engineeringvideolectures.com/course/696>

ONLINE RESOURCES:

1. <https://www.pearson.com/english/catalogue/business-english/technical-english.html>
2. <https://www.cambridgeenglish.org/learning-english/free-resources/>

OUTCOMES:

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

- Comprehend conversations and talks presented in English (K2)
- Speak fluently in informal and formal contexts (K1)
- Read articles of any kind and be able to comprehend (K2)
- Write technical concepts in simple and lucid style (K2)
- Prepare informal letters and e-mails efficiently (K3)
- Present technical concepts and summaries in correct grammar and vocabulary (K1)

CO - PO MAPPING :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| Co1 | - | 2 | - | - | - | - | 1 | - | - | 3 | - | - |
| CO2 | 1 | - | - | - | - | - | - | - | - | 3 | - | - |
| CO3 | - | - | - | - | - | - | - | - | - | - | 3 | 2 |
| CO4 | - | 3 | - | - | - | - | - | - | 2 | - | - | - |
| CO5 | - | - | - | - | - | - | - | - | - | 3 | - | - |
| CO6 | - | - | - | - | - | - | 3 | - | - | - | 2 | - |

SEMESTER - I

| | | | | | | | | |
|-------------------------------|----------------------------|--|--|--|----------|----------|----------|----------|
| 20BSPH101 SDG NO. 4 | ENGINEERING PHYSICS | | | | L | T | P | C |
| | | | | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To educate and enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology

UNIT I CRYSTAL PHYSICS**9**

Single crystalline, Polycrystalline and Amorphous materials - single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal - Miller indices - Interplanar distance - Powder diffraction method - Debye Scherer formula - Calculation of number of atoms per unit cell - Atomic radius - Coordination number - packing factor for SC, BCC, FCC and HCP structures - Polymorphism and allotropy - Diamond and Graphite structure (qualitative) - Growth of single crystals: Solution and Melt growth Techniques.

UNIT II PROPERTIES OF MATTER**9**

Elasticity - Stress - strain diagram and its uses - Poisson's ratio - Relationship between three moduli of elasticity (qualitative) - Factors affecting elastic modulus and tensile strength - Twisting couple - shaft - 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 - stress due to bending in beams.

UNIT III QUANTUM PHYSICS**9**

Black body radiation - Planck's theory (derivation) - Compton effect: theory -

wave particle duality - electron diffraction - progressive waves - wave equation - concept of wave function and its physical significance - Schrödinger's wave equation - Time independent and Time dependent equations - particle in a box (one dimensional motion) - Tunneling (qualitative) - scanning tunneling microscope.

UNIT IV LASERS AND FIBER OPTICS

9

Lasers: population of energy levels, Einstein's A and B coefficients derivation - pumping methods - resonant cavity, optical amplification (qualitative) - three level and four level laser - CO₂ laser - Semiconductor lasers: Homojunction and Heterojunction.

Fiber optics: Principle, Numerical aperture and Acceptance angle - Types of optical fibers (material, refractive index, mode) - Losses associated with optical fibers - Fiber Optical Communication system (Block diagram) - Fiber optic sensors: pressure and displacement.

UNIT V THERMAL PHYSICS

9

Transfer of heat energy - thermal expansion of solids and liquids - bimetallic strips - thermal conduction, convection and radiation - heat conduction in solids (qualitative) - thermal conductivity - Forbe's and Lee's disc method: theory and experiment - conduction through compound media (series and parallel) - thermal insulation - applications: heat exchangers, refrigerators and solar water heaters.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. D.K. Bhattachary & T.Poonam, "Engineering Physics". Oxford University Press, 2015.
2. R.K. Gaur & S.L. Gupta, "Engineering Physics". Dhanpat Rai Publishers, 2012.
3. B.K. Pandey & S.Chaturvedi, "Engineering Physics", Cengage Learning India, 2017.
4. V. Rajendran, "Engineering Physics", Mc Graw Hill Publications Ltd. New Delhi, 2014.
5. M.N. Avadhanulu & P.G. Kshirshagar, "A textbook of Engineering Physics", S. Chand & Co Ltd. 2016.

REFERENCES:

1. D. Halliday, . Resnick & J. Walker, "Principles of Physics", Wiley, 2015.
2. R.A. Serway, & J.W. Jewett, "Physics for Scientists and Engineers", Cengage Learning, 2010.
3. N.K. Verma, "Physics for Engineers", PHI Learning Private Limited, 2014.

- P.A. Tipler & G. Mosca "Physics for Scientists and Engineers", W.H.Freeman, 2020.
- Brijlal and Subramanyam, "Properties of Matter", S. Chand Publishing, 2018.
- Shatendra Sharma & Jyotsna Sharma, "Engineering Physics", Pearson, 2018.

OUTCOMES :

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

- Understand the basics of crystals, structures and crystal growth techniques (K3)
- Select a right choice of materials based on their properties for potential applications / acquire fundamental knowledge on elasticity and its applications relevant to the field of engineering (K3)
- Apply the advanced physics concepts of quantum theory to characterize the matter (K4)
- Understand the basic concepts in laser and its types and fiber optics (K3)
- Acquire adequate knowledge on the fundamental concepts of thermal properties of materials (K2)
- Evaluate the applications of powder diffraction method, optical fibers in sensors, quantum mechanical tunneling and thermal materials in expansion joints and heat exchangers (K4)

CO - PO MAPPING :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| C01 | 3 | 2 | 3 | 3 | - | - | - | - | - | - | - | 1 |
| C02 | 3 | 2 | 3 | 3 | - | - | 2 | - | - | - | - | 3 |
| C03 | 3 | 3 | 3 | 2 | - | - | 3 | - | - | - | - | 2 |
| C04 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 3 |
| C05 | 3 | 3 | 3 | 3 | - | - | 3 | - | - | - | - | 3 |
| C06 | 3 | 3 | 3 | 3 | - | - | 3 | - | - | - | - | 3 |

SEMESTER - I

| | | | | | |
|----------------------------|-----------------------|---|---|---|---|
| 20BSCY101 SDG NO. 4,6&7 | ENGINEERING CHEMISTRY | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques
- To illustrate the principles of electrochemical reactions, redox reactions in corrosion of materials and methods for corrosion prevention and protection of materials
- To categorize types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels
- To demonstrate the principles and generation of energy in batteries, nuclear reactors, solar cells, windmills and fuel cells
- To recognize the applications of polymers, composites and nano-materials in various fields

UNIT I WATER TECHNOLOGY AND SURFACE CHEMISTRY 9

Water Technology : Introduction – Hard water and Soft water. Hardness of water – types – expression of hardness (numerical problems). Boiler troubles – scale and sludge, priming and foaming, caustic embrittlement and boiler corrosion. Treatment of boiler feed water – Internal treatment (carbonate, phosphate, calgon, colloidal and sodium aluminate conditioning). External treatment – Ion exchange process, Zeolite process – Domestic water treatment (break point chlorination) – Desalination of brackish water – Reverse Osmosis.

Surface Chemistry: Adsorption – types – adsorption of gases on solids – adsorption of solutes from solution – applications of adsorption – role of adsorbents in catalysis and pollution abatement.

UNIT II ELECTROCHEMISTRY AND CORROSION 9

Electrochemistry: Cells – types (electrochemical and electrolytic cell) Redox reaction – single electrode potential (oxidation potential and reduction potential) – measurement and applications – Nernst equation (derivation and problems) – electrochemical series and its significance.

Corrosion: Causes, factors and types – chemical and electrochemical corrosion (galvanic, differential aeration). Corrosion control – material selection and design aspects, cathodic protection methods (sacrificial anodic and impressed current cathodic method) and corrosion inhibitors. Paints: Constituents and its functions. Electroplating of Copper and electroless plating of Nickel.

UNIT III FUELS AND COMBUSTION**9**

Fuels: Introduction – classification of fuels – Coal – analysis of coal (proximate and ultimate). Carbonization – manufacture of metallurgical coke (Otto Hoffmann method) – Petroleum – manufacture of synthetic petrol (Bergius process). Knocking – octane number and cetane number – Gaseous fuels – Compressed natural gas (CNG), Liquefied petroleum gases (LPG). Biofuels – Gobar gas and Biodiesel.

Combustion of Fuels: Introduction – calorific value – higher and lower calorific values- theoretical calculation of calorific value – flue gas analysis (ORSAT Method).

UNIT IV ENERGY SOURCES AND STORAGE DEVICES**9**

Energy sources: Nuclear fission – nuclear fusion – differences between nuclear fission and fusion – nuclear chain reactions – nuclear energy – light water nuclear power plant – breeder reactor – solar energy conversion – solar cells – wind energy.

Storage devices: Batteries – types of batteries – primary battery (dry cell) secondary battery (lead acid battery, lithium-ion-battery), fuel cells – H_2 - O_2 fuel cell and super capacitors.

UNIT V POLYMERS AND NANOMATERIALS**9**

Polymers: Classification – types of polymerization – mechanism (Free radical polymerization) –Engineering polymers: Nylon-6, Nylon-6,6, Teflon, Kevlar and PEEK – preparation, properties and uses – Plastic and its types – Conducting polymers – types and applications. Composites – definition, types, polymer matrix composites – FRP.

Nanomaterials: Introduction – Nanoparticles, Nanoclusters, Nanorods, Nanotubes (CNT: SWNT and MWNT) and Nanowires – Properties (surface to volume ratio, melting point, optical and electrical), Synthesis (precipitation, thermolysis, hydrothermal, electrodeposition, chemical vapour deposition, laser ablation, sol-gel process) and Applications.

TOTAL: 45 PERIODS**TEXT BOOKS:**

1. S. S. Dara and S. S. Umare, "A Textbook of Engineering Chemistry", S. Chand & Company LTD, New Delhi, 2015.
2. P. C. Jain and Monika Jain, "Engineering Chemistry" DhanpatRai Publishing Company (P) LTD, New Delhi, 2015.
3. S. Vairam, P. Kalyani and Suba Ramesh, "Engineering Chemistry", Wiley India PVT, LTD, New Delhi, 2013.

REFERENCES:

1. Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014.
2. Prasanta Rath, "Engineering Chemistry", Cengage Learning India PVT, LTD, Delhi, 2015.
3. Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, 2015.

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

1. Identify the origin of water resources and develop innovative methods to produce soft water for industrial use and potable water at cheaper cost. (K2)
2. Recognize the basic design of adsorption systems and its industrial applications and the basics concepts of electrochemistry to understand battery technology. (K2)
3. Apply the principles of electrochemistry to corrosion process and the applications of protective coatings to overcome the corrosion. (K3)
4. Disseminating the knowledge about the chemistry of fuels and combustion and its application in various levels. (K2)
5. Acquire the basics of non-conventional sources of energy and understand the principles and the reaction mechanism of batteries and fuel cells.. (K3)
6. Illustrate the synthesis and applications of polymers, composites and nano-materials. (K2)

CO – PO MAPPING:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | 3 | 1 | 2 | - | - | 1 | 2 | - | - | - | - | 1 |
| CO2 | 3 | 2 | 2 | 2 | 1 | 1 | 2 | - | - | - | - | 3 |
| CO3 | 3 | 2 | 3 | 2 | 1 | 1 | 2 | - | - | - | 1 | 1 |
| CO4 | 3 | 1 | 2 | 2 | - | 1 | 2 | - | - | - | 1 | 1 |
| CO5 | 3 | 2 | 3 | 1 | 1 | 1 | 2 | - | - | - | 1 | 3 |
| CO6 | 3 | 2 | 3 | 1 | - | 1 | 1 | - | - | - | 1 | 2 |

SEMESTER - I

| | | | | | |
|---------------------------------|---|----------|----------|----------|----------|
| 20ESCS101 SDG NO. 4&9 | PROBLEM SOLVING AND PROGRAMMING IN C | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To understand about the programming language
- To develop C Programs using basic Programming Constructs, Loops Arrays and Strings
- To develop applications in C using Functions, Pointers and Structures
- To perform I/O operations and File Handling in C

UNIT I INTRODUCTION TO PROGRAMMING AND ALGORITHMS FOR PROBLEM SOLVING

10

The Basic Model of Computation, Programming Paradigms- Program Development Life Cycle - Algorithm –Pseudo Code - Flow Chart - Programming Languages - Compilation - Linking and Loading - Testing and Debugging - Documentation - Control Structures – Algorithmic Problem Solving- Problems Based on Sequential, Decision Making - Branching and Iteration.

UNIT II BASICS OF C PROGRAMMING

8

Structure of C program - C programming: Data Types – 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 III 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 – Selection Sort - Linear and Binary Search.

UNIT IV FUNCTIONS AND POINTERS

9

Introduction to Functions: Function Prototype, Function Definition, Function Call, Built-in Functions (String Functions, Math Functions) – Recursion – Example Program: Computation of Sine Series - Scientific Calculator using Built-in Functions - Binary Search using Recursive Functions – Pointers – Pointer Operators – Pointer Arithmetic – Arrays and Pointers –

Array of Pointers – Example Program: Sorting of Names – Parameter Passing: Pass by Value - Pass by Reference – Example Program: Swapping of Two Numbers using Pass by Reference.

UNIT V STRUCTURES and FILE PROCESSING

9

Structure - Nested Structures – Pointer and Structures – Array of Structures – Example Program using Structures and Pointers – Self Referential Structures – Dynamic Memory Allocation - Singly Linked List – Typedef.

Files – Types of File Processing: Sequential Access, Random Access – Sequential Access File - Example Program: Finding Average of Numbers stored in Sequential Access File - Random Access File - Example Program: Transaction Processing Using Random Access Files – Command Line Arguments.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Reema Thareja, “Programming in C”, Oxford University Press, Second Edition, 2016.
2. Kernighan, B.W and Ritchie, D.M, “The C Programming language”, Second Edition, Pearson Education, 2012.

REFERENCES:

1. Paul Deitel and Harvey Deitel, “C How to Program”, Seventh edition, Pearson Publication.
2. Jeri R. Hanly & Elliot B. Koffman, “Problem Solving and Program Design in C”, Pearson Education, 2013.
3. Pradip Dey, Manas Ghosh, “Fundamentals of Computing and Programming in C”, First Edition, Oxford University Press, 2009.
4. Anita Goel and Ajay Mittal, “Computer Fundamentals and Programming in C”, Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
5. Byron S. Gottfried, "Schaum's Outline of Theory and Problems of Programming with C", McGraw-Hill Education, 1996.
6. Kanetkar Y, “Let us C”, BPB Publications, 2007.
7. Hanly J R & Koffman E.B, “Problem Solving and Programme design in C”, Pearson Education, 2009.

WEB REFERENCES:

1. <https://www.learn-c.org/>
2. <https://codeforwin.org/>
3. <https://www.cprogramming.com/>

ONLINE RESOURCES:

1. https://www.linuxtopia.org/online_books/programming_books/gnu_c_programming_tutorial
2. <https://nptel.ac.in/courses/106105171>
3. https://swayam.gov.in/nd1_noc19_cs42/preview

OUTCOMES:**Upon completion of the course, the student should be able to**

1. Develop efficient algorithms for solving a problem. (K2)
2. Use the various constructs in C to develop simple applications. (K3)
3. Design and Implement applications using Array & Strings. (K3)
4. Develop applications using Functions and Pointers. (K6)
5. Design and Develop applications using Structures. (K3)
6. Design and Develop applications using Files. (K4)

CO- PO MAPPING :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PS01 | PS02 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| C01 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | - | 2 | 2 | - | 3 | 2 | 3 |
| C02 | 3 | 3 | 3 | 3 | 2 | - | 1 | 1 | 2 | 2 | 3 | 3 | 2 | 3 |
| C03 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 1 | 2 | - | 3 | - | 3 | 2 |
| C04 | 3 | 3 | 3 | 3 | 2 | 1 | - | 1 | 2 | 2 | 3 | 3 | 1 | 2 |
| C05 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 1 | 2 | 2 | 3 | 3 | 2 | 1 |
| C06 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 1 | 2 | 2 | 3 | 3 | 3 | 2 |

SEMESTER - I

| | | | | | |
|--|-----------------------------|----------|----------|----------|----------|
| 20ESGE101 SDG NO. 4,6,7, 9, 12,14 &15 | ENGINEERING GRAPHICS | L | T | P | C |
| | | 1 | 2 | 0 | 3 |

OBJECTIVES:

- To develop in students, graphic skills for communication of concepts, ideas and design of engineering products
- To visualize the job in three dimensions
- To have a clear conception and appreciation of the shape, size, proportion and design
- To expose the student community to existing national standards related to technical drawings

CONCEPTS AND CONVENTIONS (Not for Examination) 3

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning- Projection of Points

UNIT I PLANE CURVES AND FREEHAND SKETCHING 6+9

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid on Horizontal Surfaces – construction of involutes of circle for one complete revolution – Drawing of tangents and normal to the above curves.

Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Freehand sketching of multiple views from pictorial views of objects.

UNIT II PROJECTION OF LINES AND PLANE SURFACE 6+9

Orthographic projection- principles-Principal planes- Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method-Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS 6+9

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one of the principal planes by rotating object method.

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 6+9

Sectioning of prisms, pyramids, cylinder and cone in simple vertical position when the cutting plane is inclined to one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and truncated solids in vertical position – Prisms, pyramids cylinder and cone.

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 6+9

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinder, cone- Perspective projection of simple solids-Prisms, pyramids and cylinder by visual ray method.

TOTAL: 78 PERIODS

TEXT BOOKS:

1. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2008.
2. T. Jeyapooan, "Engineering Graphics using AUTOCAD", Vikas Publishing House Pvt Ltd, 7th Edition.

REFERENCES:

1. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 50th Edition, 2010.
2. Natrajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2009.
3. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
4. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
5. Luzzader, Warren.J. and Duff, John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
6. N S Parthasarathy and Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, 2015.
7. Shah M.B., and Rana B.C., "Engineering Drawing", Pearson, 2nd Edition, 2009.

WEB REFERENCES:

1. <https://nptel.ac.in/courses/112/103/112103019/>

ONLINE RESOURCES:

1. <https://nptel.ac.in/courses/105/104/105104148/>

PUBLICATION OF BUREAU OF INDIAN STANDARDS:

1. IS10711 – 2001: Technical products Documentation – Size and lay out of drawingsheets.
2. IS9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods

OUTCOMES:

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

1. Relate thoughts and ideas graphically in a neat fashion and ability to perform sketching of engineering curves used in engineering practices, multiple views of objects. (K1)
2. Understand the concepts of orthographic projections for basic geometrical constructions. (K2)
3. Acquire the knowledge of orthographic projection in three dimensional object. (K2)
4. Develop knowledge about Sectioning and apply interior shapes of solids. (K3)
5. Analyze the concepts of design in developing various 3 dimensional projections. (K4)
6. Build a strong foundation to analyze the design in various dimensions. (K4)

CO - PO, PSO MAPPING:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| C01 | 3 | 2 | 2 | - | - | - | - | - | 2 | 2 | - | 2 | 2 | 2 |
| C02 | 3 | 2 | 2 | - | - | - | - | - | 2 | 2 | - | 2 | 2 | 2 |
| C03 | 3 | 2 | 2 | - | - | - | - | - | 2 | 2 | - | 2 | 2 | 2 |
| C04 | 3 | 2 | 2 | - | - | - | - | - | 2 | 2 | - | 2 | 2 | 2 |
| C05 | 3 | 2 | 2 | - | - | - | - | - | 2 | 2 | - | 2 | 2 | 2 |
| C06 | 3 | 2 | 2 | - | - | - | - | - | 2 | 2 | - | 2 | 2 | 2 |

SEMESTER - I

| | | | | | |
|-------------------------------|---|----------|----------|----------|------------|
| 20BSPL101 SDG NO. 4 | PHYSICS AND CHEMISTRY LABORATORY | L | T | P | C |
| | | 0 | 0 | 3 | 1.5 |

PHYSICS LABORATORY**OBJECTIVES:**

- To acquaint the students with practical knowledge of physics principles in various fields such as optics, thermal physics and properties of matter for developing basic experimental skills
- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis

LIST OF EXPERIMENTS (Any 5 Experiments)

1. Determination of Young's modulus by non-uniform bending method.
2. Determination of rigidity modulus –Torsion pendulum.
3. Determination of velocity of sound and compressibility of liquid – Ultrasonic Interferometer.
4. (a) Determination of wavelength and particle size using Laser.
(b) Determination of acceptance angle in an optical fiber.
5. Determination of thermal conductivity of a bad conductor – Lee's Disc method.
6. Determination of specific resistance of a given coil of wire – Carey Foster's bridge.
7. Determination of wavelength of mercury spectrum – spectrometer grating.
8. Determination of band gap of a semiconductor.
9. Determination of Hall coefficient by Hall Effect experiment.
10. Determination of solar cell characteristics.

**LAB REQUIREMENTS FOR A BATCH OF 30 STUDENTS /
6 (max.) STUDENTS PER EXPERIMENT**

- | | |
|--|-----------|
| 1. Young's modulus by non-uniform bending method- experimental set-up | – 12 sets |
| 2. Rigidity modulus - Torsion pendulum experimental set-up | – 12 sets |
| 3. Ultrasonic Interferometer to determine velocity of sound and compressibility of liquid | – 6 sets |
| 4. (a) Experimental set-up to find the wavelength of light, and to find particle size using Laser | – 6 sets |
| (b) Experimental set-up to find acceptance angle in an optical fiber | – 6 sets |
| 5. Lee's disc method- experimental set up to find thermal conductivity of a bad conductor | – 6 sets |
| 6. Experimental set-up to find specific resistance of a coil of wire-Carey Foster's Bridge | – 6 sets |
| 7. Experimental set-up to find the wavelength of mercury spectrum-spectrometer grating | – 6 sets |
| 8. Experimental set-up to find the band gap of a semiconductor | – 12 sets |
| 9. Experimental set-up to find the Hall coefficient by Hall Effect Experiment | – 6 sets |
| 10. Experimental set-up to study characteristics of solar cells | – 6 sets |

TEXTBOOKS:

1. J.D. Wilson & C.A. Hernandez Hall "Physics Laboratory Experiments" Houghton Mifflin Company, New York, 2010.
2. M.N. Srinivasan, S. Balasubramanian & R. Ranganathan, "Practical Physics", S. Chand & Sons educational publications, New Delhi, 2011.
3. R. Sasikumar, "Practical Physics", PHI Learning Pvt. Ltd., New Delhi, 2011.

CHEMISTRY LABORATORY**(Any five experiments to be conducted)****OBJECTIVES:**

- To acquaint the students with practical knowledge of the basic concepts of chemistry, the student faces during the course of their study in the industry and engineering field
- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis
- To understand and develop experimental skills for building technical competence

LIST OF EXPERIMENTS (Any five experiments to be conducted)

1. Estimation of HCl using Na_2CO_3 as primary standard and Determination of alkalinity in water samples.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
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. Conductometric titration of strong acid vs strong base.
7. Estimation of iron content of the given solution using potentiometer.
8. Estimation of iron content of the water sample using spectrophotometer (1, 10- Phenanthroline / thiocyanate method).
9. Estimation of sodium and potassium present in water using flame photometers.
10. Determination of molecular weights of polymers using Ostwald's Viscometer.

**LAB REQUIREMENTS FOR A BATCH OF 30 STUDENTS /
6 (MAX.) STUDENTS PER EXPERIMENT.**

- | | |
|---|----------|
| 1. Estimation of HCl using Na_2CO_3 as primary standard and Determination of alkalinity in water sample | - 6 sets |
| 2. Determination of total, temporary & permanent hardness of water by EDTA method | - 6 sets |
| 3. Determination of DO content of water sample by Winkler's method | - 6sets |
| 4. Determination of chloride content of water sample by argentometric method | - 6 sets |
| 5. Determination of strength of given hydrochloric acid using pH meter | - 6 sets |
| 6. Conductometric titration of strong acid vs strong base | - 6 sets |
| 7. Estimation of iron content of the given solution using potentiometer | - 6 sets |
| 8. Estimation of iron content of the water sample using spectrophotometer (1,10- Phenanthroline / thiocyanate method) | - 2 sets |
| 9. Estimation of sodium and potassium present in water using flame photometer | - 2 sets |
| 10. Determination of molecular weights of polymer using Ostwald's Viscometer. | - 6 sets |

TOTAL: 30 PERIODS

TEXTBOOKS:

1. Vogel's Textbook of Quantitative Chemical Analysis (8th edition, 2014).

OUTCOMES:

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

1. Apply the principles of thermal physics and properties of matter to evaluate the properties of materials and to determine the physical properties of liquid using ultrasonic interferometer. (K1)
2. Understand measurement technique and usage of new instruments in optics for real time application in engineering. (K2)
3. Apply the knowledge of semiconductor materials to evaluate the band gap and Hall coefficient of materials and to study the characteristics of solar cell for engineering solutions. (K3)
4. Apply the different techniques of quantitative chemical analysis to generate experimental skills in building technical competence. (K2)
5. Apply basic techniques used in chemistry laboratories for water

analyses/purification and estimates the ions/metal ions present in domestic/industry wastewater. (K2)

6. Utilize the fundamental laboratory techniques for analyses such as volumetric titrations, conductometric, potentiometric and spectroscopy. (K2)

CO-PO MAPPING :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | 3 | 3 | 3 | 2 | 1 | 3 | 3 | 2 | 2 | 1 | 1 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 2 | 3 |
| CO4 | 3 | 2 | 3 | 3 | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 2 |
| CO5 | 3 | 2 | 3 | 3 | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 2 |
| CO6 | 3 | 2 | 3 | 3 | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 2 |

SEMESTER - I

| | | | | | |
|--------------------------|-----------------------------|---|---|---|-----|
| 20ESPL101 SDG NO. 4&9 | PROGRAMMING IN C LABORATORY | L | T | P | C |
| | | 0 | 0 | 3 | 1.5 |

OBJECTIVES:

- To develop programs in C using basic Programming Constructs
- To develop applications in C using Arrays and Strings
- To design and implement applications in C using Functions, Structures
- To develop applications in C using Files

LIST OF EXPERIMENTS

1. Write a program using I/O statements and expressions.
2. Write programs using decision-making constructs.
3. Write a program to find whether the given year is leap year or not? (Hint: not every centurion year is a leap. For example 1700, 1800 and 1900 is not a leap year)
4. Write a program to perform the Calculator operations, namely, addition, subtraction, multiplication, division and square of a number.
5. Write a program to check whether a given number is Armstrong number

or not?

6. Write a program to check whether a given number is odd or even?
7. Write a program to find the factorial of a given number.
8. Write a program to find out the average of 4 integers.
9. Write a program to display array elements using two dimensional arrays.
10. Write a program to perform swapping using function.
11. Write a program to display all prime numbers between two intervals using functions.
12. Write a program to reverse a sentence using recursion.
13. Write a program to get the largest element of an array using the function.
14. Write a program to concatenate two string.
15. Write a program to find the length of String.
16. Write a program to find the frequency of a character in a string.
17. Write a program to store Student Information in Structure and Display it.
18. The annual examination is conducted for 10 students for five subjects. Write a program to read the data and determine the following:
 - (a) Total marks obtained by each student.
 - (b) The highest marks in each subject and the marks of the student who secured it.
 - (c) The student who obtained the highest total marks.
19. Insert, update, delete and append telephone details of an individual or a company into a telephone directory using random access file.
20. Count the number of account holders whose balance is less than the minimum balance using sequential access file.

TOTAL: 45 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Standalone desktops with C compiler

30 Nos.

(or)

Server with C compiler supporting 30 terminals or more.

OUTCOMES:

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

1. Solve some simple problems leading to specific applications. (K6)
2. Demonstrate C programming development environment, compiling, debugging, linking and executing a program. (K6)
3. Develop C programs for simple applications making use of basic constructs, arrays and strings. (K6)

4. Develop C programs involving functions and recursion. (K6)
5. Develop C programs involving pointers, and structures. (K6)
6. Design applications using sequential and random access file. (K6)

CO- PO, PSO MAPPING:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 1 | 2 | 2 | 3 | 3 | 2 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 2 | 1 | - | 1 | 2 | 2 | 3 | 3 | 1 | 3 |
| CO3 | 3 | 3 | - | 3 | 2 | - | 1 | 1 | - | 2 | - | 3 | 3 | 2 |
| CO4 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 1 | 2 | 2 | 3 | 3 | 1 | 3 |
| CO5 | 3 | 3 | 3 | - | 2 | - | 1 | - | 2 | 2 | 3 | - | 2 | 1 |
| CO6 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 1 | 2 | - | 3 | 3 | 3 | 2 |

SEMESTER - I

| | | | | | |
|---------------------------------|--------------------------|----------|----------|----------|----------|
| 20TPHS101 SDG NO. 4&5 | SKILL ENHANCEMENT | L | T | P | C |
| | | 0 | 0 | 2 | 1 |

OBJECTIVES:

- To enrich social network ethics
- To develop and enhance browsing culture
- To understand the concepts of networking
- To promote self professionalism
- To acquire knowledge about various digital identification procedures

UNIT I SOCIAL NETWORK ETIQUETTES**6**

Introduction to social network – Social Networking Etiquettes - Pros and Cons - Usage of Facebook, Instagram, WhatsApp, Telegram, Youtube, Evolution of Android and IOS, Introduction to LinkedIn & Benefits. (Practicals – Official Mail id- LinkedIn Id Creation, LinkedIn Profile Building, Facebook Id and Creation and Modifying the existing FB ID)

UNIT II BROWSING CULTURE**6**

Introduction to browsing – Search Engines-Google - Bing -Yahoo!-AOL -MSN -DuckDuckGo ,browsers, phishing – Cookies - URL – https:// extensions , browsing history, Incognito mode-VPN – Pros and Cons – Book mark.

UNIT III NETWORKING**6**

Basics of networking - LAN, MAN, WAN, Introduction to network topologies, Protocols , IP Commands (Command line prompt), Define online compiler and editor (Practicals – Find Your System IP,Ping Command, Firewall Fortinet, Basic DOS Commands)

UNIT IV PROFESSIONALISM**6**

Dress Code, Body Language, Appropriate Attire ,Communication Skills, Interview preparation – Introducing yourself - How to greet Superiors, Importance of Eye Contact During conversation.

UNIT V DIGITAL IDENTIFICATION**6**

Introduction to NAD - Importance of Aadhar, PAN Card, Passport, Bank Account, Bar Code, QR scan, Payment Gateway (Gpay, Phone Pe, UPI, BHIM, Paytm), Mobile Banking (Practicals - NAD registration Step by Step, Linking bank account with netbanking, Register for payment gateway).

TOTAL : 30 PERIODS**WEB REFERENCES:****Unit I: Social Network Etiquettes:**

1. <https://sproutsocial.com/glossary/social-media-etiquette/>
2. <https://www.shrm.org/resourcesandtools/tools-and-samples/hr-qa/pages/socialnetworkingsitespolicy.aspx>
3. <https://www.frontiersin.org/articles/10.3389/fpsyg.2019.02711/full>
4. <https://medium.com/@sirajea/11-reasons-why-you-should-use-telegram-instead-of-whatsapp-ab0f80fbfa79>
5. <https://buffer.com/library/how-to-use-instagram/>
6. <https://www.webwise.ie/parents/what-is-youtube/>
7. <https://www.androidauthority.com/history-android-os-name-789433/>
8. <https://www.mindtools.com/pages/article/linkedin.htm>

Unit II: Browsing Culture:

1. <https://sites.google.com/site/bethanycollegeofteacheredn/unit-ict-connecting-with-world/national-policy-on-information-and-communication-technology-ict/accessing-the-web-introduction-to-the-browser-browsing-web>
2. <https://www.wordstream.com/articles/internet-search-engines-history>
3. <https://www.malwarebytes.com/phishing/>
4. <https://www.adpushup.com/blog/types-of-cookies/>

5. <https://www.eff.org/https-everywhere>
6. <https://www.sciencedirect.com/topics/computer-science/browsing-history>
7. <https://www.vpnmentor.com/blog/pros-cons-vpn/>
8. <https://www.tech-wonders.com/2016/10/use-hush-private-bookmarking-extension-chrome.html>

Unit III: Networking

1. <https://www.guru99.com/types-of-computer-network.html>
2. <https://www.studytonight.com/computer-networks/network-topology-types>
3. <https://www.cloudflare.com/learning/network-layer/what-is-a-protocol/>
4. <https://www.howtogeek.com/168896/10-useful-windows-commands-you-should-know/>
5. <https://paiza.io/en>

Unit IV : Professionalism

1. <https://career.vt.edu/develop/professionalism.html>
2. <https://englishlabs.in/importance-dress-code/>
3. <https://www.proschoolonline.com/blog/importance-of-body-language-in-day-to-day-life>
4. <https://www.thespruce.com/etiquette-of-proper-attire-1216800>
5. <https://shirleytaylor.com/why-are-communication-skills-important/>
6. <https://www.triad-eng.com/interview-tips-for-engineers/>
7. <https://www.indeed.co.in/career-advice/interviewing/interview-question-tell-me-about-yourself>
8. <https://toggl.com/track/business-etiquette-rules/>

Unit V: Digital Identification

1. <https://nad.ndml.in/nad-presentation.html>
2. <https://www.turtlemint.com/aadhaar-card-benefits/>
3. <https://www.bankbazaar.com/pan-card/uses-of-pan-card.html>
4. <https://www.passportindex.org/passport.php>
5. <https://consumer.westchestergov.com/financial-education/money-management/benefits-of-a-bank-account>
6. https://en.wikipedia.org/wiki/QR_code
7. <https://www.investopedia.com/terms/p/payment-gateway.asp>
8. <https://www.paisabazaar.com/banking/mobile-banking/>

OUTCOMES:

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

1. Learn and apply social network ethics. (K3)
2. Understand the browsing culture. (K2)
3. Analyze the networking concepts. (K4)
4. Develop self professionalism. (K3)
5. Gain hands-on experience in various digital identification procedures. (K2)
6. Analyse and apply the different digital payment gateway methods. (K4)

CO- PO MAPPING:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | - | - | - | - | 3 | 2 | - | 3 | 2 | 3 | - | 2 |
| CO2 | - | - | - | - | 3 | 2 | - | 3 | 2 | 3 | - | 2 |
| CO3 | - | - | - | - | 3 | 2 | - | - | 1 | 3 | - | 2 |
| CO4 | - | - | - | - | 3 | 2 | - | 3 | 3 | 3 | - | 2 |
| CO5 | - | - | - | - | 3 | 2 | - | - | 2 | 3 | - | 2 |
| CO6 | - | - | - | - | 3 | 2 | - | - | 2 | 3 | - | 2 |

SEMESTER - I

| | | | | | |
|--------------------------|-----------------|---|---|---|---|
| 20HSMG101 SDG NO. 4&5 | PERSONAL VALUES | L | T | P | C |
| | | 2 | 0 | 0 | 0 |

OBJECTIVES:

- Values through Practical activities

UNIT I SELF CONCEPT**6**

Understanding self Concept – Identify Yourself – Who am I – an individual, engineer, citizen – Attitude – Measuring Behaviour – Change of Behaviour – Personality – Characteristics in personal, professional life.

UNIT II INDIVIDUAL VALUES**6**

Personal Values – Attributes – Courage – Creativity, Honesty, Perfection, Simplicity, Responsibility – Measuring personal values

UNIT III MORAL VALUES**6**

Moral – Understanding right and wrong – Positive thoughts – Respect to others – Doing good to society.

UNIT IV PHYSICAL AND MENTAL WELL-BEING**6**

Health – Physical fitness – Mental vigour – Diet management – Yoga – Meditation – Peaceful life – Happiness in life

UNIT V DECISION MAKING**6**

Goal Setting – Decision making skill – Overcome of Barriers – Success – Mental strength and weakness

TOTAL: 30 PERIODS**Note:**

Each topic in all the above units will be supplemented by practice exercises and classroom activities and projects.

REFERENCE BOOKS:

1. Barun K. Mitra, "Personality Development and Soft Skills", Oxford University Press, 2016.
2. B.N.Ghosh, "Managing Soft Skills for Personality Development" McGraw Hill India, 2012.

OUTCOMES:

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

1. Become an individual in knowing the self. (K4)
2. Acquire and express Personal Values, Spiritual values and fitness. (K4)
3. Practice simple physical exercise and breathing techniques. (K2)
4. Practice Yoga asana which will enhance the quality of life. (K1)
5. Practice Meditation and get benefitted. (K1)
6. Understanding moral values and need of physical fitness. (K2)

CO – PO MAPPING:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| Co1 | - | - | - | - | - | 2 | 2 | 3 | 3 | 1 | 1 | 1 |
| CO2 | - | - | - | - | - | 2 | 2 | 3 | 3 | 1 | 1 | 1 |
| CO3 | - | - | - | - | - | 2 | 2 | 3 | 3 | 1 | 1 | 1 |
| CO4 | - | - | - | - | - | 2 | 2 | 3 | 3 | 1 | 1 | 1 |
| CO5 | - | - | - | - | - | 2 | 2 | 3 | 3 | 1 | 1 | 1 |
| CO6 | - | - | - | - | - | 2 | 2 | 3 | 3 | 1 | 1 | 1 |

SEMESTER - II

| | | | | | |
|-------------------------------|-------------------------------------|----------|----------|----------|----------|
| 20BSMA201 SDG NO. 4 | ENGINEERING MATHEMATICS - II | L | T | P | C |
| | | 3 | 1 | 0 | 4 |

OBJECTIVES:

- The objective of this course is to familiarize the prospective engineers with techniques in Vector Calculus, Ordinary differential equations, Complex variables and Laplace transforms. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

UNIT I VECTOR CALCULUS

12

Gradient and Directional derivatives - Divergence and Curl- Vector identities - Irrotational and Solenoidal vector fields - Line integral over a plane curve - Surface integral - Volume integral – Gauss divergence, Green's and Stoke's theorems - Verification and application in evaluating line, Surface and volume integrals.

UNIT II ORDINARY DIFFERENTIAL EQUATIONS

12

Second and higher order linear differential equations with constant coefficients - Method of variation of parameters - Homogeneous equation of Euler's and Legendre's types - System of simultaneous linear differential equations with constant coefficients.

UNIT III COMPLEX DIFFERENTIATION

12

Analytic functions- Necessary and sufficient conditions for analyticity in cartesian and polar coordinates (without proof) - Properties - Harmonic conjugate - construction of analytic functions- Conformal mapping - Mapping by functions $w = z+a, w=az, w=1/z, w=z^2$ - Bilinear transformation.

UNIT IV COMPLEX INTEGRATION

12

Contour integrals, Cauchy- Goursat theorem (without proof) - Cauchy Integral formula (without proof) - Taylor's series - Zeroes of Analytic functions - Singularities - Laurent's Series - Residues – Cauchy Residue theorem (without proof) – Application of Residue theorem for evaluation of real integrals – use of circular contour and semicircular contour (without poles on real axis).

UNIT V LAPLACE TRANSFORM

12

Existence conditions – Transforms of elementary functions – Transform of Unit step function and Unit impulse function – Basic properties – Shifting

theorems – Transforms of derivatives and integrals – Initial and Final value theorems – Convolution theorem – Transform of Periodic functions – Application of solution of linear second order ordinary differential equations with constant coefficients.

TEXT BOOKS:

1. Ramana.B.V., “Higher Engineering Mathematics”, Tata McGraw Hill Publishing Company, New Delhi, 2008.
2. Erwin Kresizg, “Advance Engineering Mathematics”, 9th Edition, John Wiley & Sons, 2006.

REFERENCES:

1. Dass, H.K., and Er. Rajnish Verma, “Higher Engineering Mathematics”, S.Chand Private Ltd., 2011.
2. Glyn James, “Advanced Modern Engineering Mathematics”, 3rd Edition, Pearson Education, 2010.
3. Peter V.O'Neil, “Advanced Engineering Mathematics”, 7th Edition, Cengage learning, 2012.
4. E.A.Coddinton, “An Introduction to Ordinary Differential Equations”, Prentice Hall India, 1995.
5. B.S. Grewal, “Higher Engineering Mathematics”, Khanna Publishers, 40th Edition, 2014.
6. N.P.Bali and Manish Goyal, “A text Book of Engineering Mathematics”, Laxmi Publications, Reprint 2008.

WEB COURSES:

1. <https://nptel.ac.in/courses/122107036/>
2. <https://nptel.ac.in/courses/111105134/>
3. <https://ocw.mit.edu/courses/mathematics/18-04-complex-variables-with-applications-spring-2018/>
4. <https://ocw.mit.edu/courses/mathematics/18-02-multivariable-calculus-fall-2007/>
5. <https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/lecture-notes/>

ONLINE RESOURCES:

1. <https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/video-lectures/lecture-1-introduction/>
2. <http://www.nptelvideos.com/course.php?id=90>

COURSE OUTCOMES:**Upon completion of the course, the student should be able to**

1. Compute the derivatives of scalar point, vector point functions and evaluate line, surface and volume integrals of vector point functions using Stokes, Greens, and Gauss divergence theorems. (K3)
2. Solve Ordinary differential equations of second and higher order with constant coefficients, variable coefficients and simultaneous linear differential equations. (K3)
3. Construct an analytic function and find the harmonic conjugate, apply the properties of analytic functions to check for harmonic and orthogonal functions and find the images of regions, straight lines and points in the Z-plane under the mappings

$$w = z + a, w = az, w = \frac{1}{z}, w = z^2 \quad \text{and bilinear transformation. (K3)}$$

4. Find the Taylor's series about a point and Laurent's series in an annular region of analytic functions and Evaluate integrals of analytic functions and real integrals over circular and semicircular contour using Cauchy Goursat theorem, Cauchy integral formula and Cauchy Residue theorem. (K3)
5. Find the Laplace transforms of simple and periodic functions by applying the definition and theorems on Laplace transforms. (K3)
6. Determine the Inverse Laplace transform using the theorems, the method of partial fractions, Convolution and solve linear second order ordinary differential equations with constant coefficients using Laplace transforms. (K3)

CO - PO, PSO MAPPING:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | 3 | 3 | 2 | 1 | - | - | - | - | - | - | - | 1 |
| CO2 | 3 | 3 | 2 | 1 | - | - | - | - | - | - | - | 1 |
| CO3 | 3 | 3 | 2 | 1 | - | - | - | - | - | - | - | 1 |
| CO4 | 3 | 3 | 2 | 1 | - | - | - | - | - | - | - | 1 |
| CO5 | 3 | 3 | 2 | 1 | - | - | - | - | - | - | - | 1 |
| CO6 | 3 | 3 | 2 | 1 | - | - | - | - | - | - | - | 1 |

SEMESTER - II

| | | | | | |
|-------------------------------|-------------------------------|----------|----------|----------|----------|
| 20HSEN201 SDG NO. 4 | TECHNICAL ENGLISH - II | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To strengthen the listening skills for comprehending and critically analyzing passages
- To enhance students' ability with multiple strategies and skills for making technical presentations
- To participate in group discussions for developing group attitude
- To develop skills for preparing effective job application
- To write effective technical reports

UNIT I LANGUAGE DEVELOPMENT 9

Listening – Listening conversations involving two participants – multiple participants – **Speaking** – conversation methods in real life occurrences using expressions of different emotions and imperative usages – **Reading** passages and short stories - **Writing** – preparation of checklist – extended definition – **Language Development** – tenses - subject - verb agreement

UNIT II VOCABULARY BUILDING 9

Listening – listening formal and informal conversation and participative exercises – **Speaking** - creating greetings/wishes/excuses and thanks – **Reading** – articles/novels-**Writing** summary of articles and concise writing identifying new words – homonyms, homophones, homographs – one-word substitutions – easily confused words - creating SMS and using emoticons - sharing information in social media. **Language Development** - reported speeches – regular and irregular verbs - idioms & phrases

UNIT III WRITING TECHNICAL REPORTS 9

Listening – listening conversation – effective use of words and their sound aspects, stress, intonation & pronunciation – **Speaking** - practicing telephonic conversations – observing and responding. **Reading** – regular columns of newspapers/magazines - **Writing** – reports – feasibility, accident, survey and progress - preparation of agenda and minutes – **Language Development** - using connectives – discourse markers

UNIT IV TECHNICAL WRITING 9

Listening – Model debates & documentaries - **Speaking** – expressing agreement/disagreement, assertiveness in expressing opinions – **Reading**

biographies/autobiographies – **Writing** – note-making – formal letters – inviting guests – acceptance/declining letters - **Language Development** – degrees of comparison - numerical adjectives – embedded sentences

UNIT V GROUP DISCUSSION AND JOB APPLICATION

9

Listening – Listening - classroom lectures – recommending suggestions & solutions – **Speaking** – participating in group discussion – learning GD strategies – **Reading** – journal articles - Writing – Job application – cover letter - résumé preparation – **Language Development** – purpose statement – editing – verbal analogies.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Board of editors. Fluency in English: A Course book for Engineering and Technology. Orient Blackswan, Hyderabad 2016.
2. Ashraf Rizvi, M, Effective Technical Communication. 2nd ed. McGraw Hill, New Delhi, 2018.

REFERENCES

1. Bailey, Stephen. Academic Writing: A Practical Guide for Students. Routledge, New York, 2011.
2. Raman, Meenakshi and Sharma, Sangeetha. Technical Communication Principles and Practice. Oxford University Press, New Delhi, 2014.
3. Muralikrishnan & Mishra Sunitha, Communication skills for Engineers 2nd ed. Pearson, Tamilnadu, India 2011. P. Kiranmai and Rajeevan, Geetha. Basic Communication Skills, Foundation Books, New Delhi, 2013.
4. Suresh Kumar, E. Engineering English. Orient Blackswan, Hyderabad, 2015
5. Richards, Jack C. Interchange Students' Book – 2. Cambridge University Press, New Delhi, 2015.

WEB REFERENCES:

1. https://swayam.gov.in/nd1_noc20_hs21/preview
2. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/109106122/lec1.pdf
3. <https://freevideolectures.com/course/3250/introduction-to-film-studies/10>

ONLINE RESOURCES

1. <https://www.ef.com/wwen/english-resources/>
2. https://www.smilesforlearning.org/gclid=EAIaIQobChMI49DF9bnd6AIVSY6PCh1d_gV9EAAAYASAAEgIBPvD_BwE.

OUTCOMES:**Upon completion of the course, the student should be able to**

1. Acquire the ability to speak effectively in real life situations (K1)
2. Adapt group behaviour and execute the role as a contributing team member (K1)
3. Employ active and passive vocabulary in oral and written communication (K2)
4. Share opinions and suggestions effectively in conversations, debates and discussions (K2)
5. Prepare winning job applications (K3)
6. Write technical reports convincingly (K3)

CO - PO MAPPING:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | - | - | - | - | - | - | - | - | - | 3 | - | 2 |
| CO2 | - | 2 | - | - | - | - | - | - | - | 3 | - | - |
| CO3 | - | - | - | 1 | - | - | 2 | - | - | 3 | - | - |
| CO4 | - | - | - | - | - | 2 | - | 3 | - | - | - | - |
| CO5 | - | - | - | - | - | - | - | - | - | 3 | - | 2 |
| CO6 | - | - | - | - | - | - | - | - | - | 3 | - | 2 |

SEMESTER - II

| | | | | | |
|------------------|---------------------------|----------|----------|----------|----------|
| 20ESIT201 | PYTHON PROGRAMMING | L | T | P | C |
| SDG NO. 4 | WITH LABORATORY | 3 | 0 | 2 | 4 |

OBJECTIVES:

- To Develop Python Programs with Conditionals and Loops
- To Use Python Data Structures – Lists, Tuples, Dictionaries, Sets
- To Define Python Functions and Work with Modules and Packages
- To Work with Python Classes, Objects and Handling Exceptions

UNIT I BASICS OF PYTHON PROGRAMMING 9

Python Interpreter and Interactive Mode - Features – History of Python – Literals – Variables and Identifiers – Data Types – Input Operation – Comments – Reserved Words – Indentation – Operators and Expressions – Operator Precedence– Operations on Strings – Other Data types – Type Conversion - Illustrative Programs: Use of various Operators, Evaluation of expressions, String Operations.

UNIT II DECISION CONTROL STATEMENTS 9

Conditionals: Boolean Values and Operators, Conditional (if) - Alternative (if-else) - Chained Conditional (if-elif-else) - Iteration: state - while - for - break - continue - pass - Illustrative Programs: Exchange the Values of Two Variables - Circulate the values of N Variables - Distance Between Two Points - Square Root - GCD - Exponentiation - Sum and Array of Numbers.

UNIT III STRING, LISTS, TUPLES, DICTIONARIES, SETS 9

Strings: String Slices - Immutability - String functions and methods - String Module - 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 - Sets: Creating Sets – Operations and Methods – Set Comprehension - Illustrative programs: Linear Search - Binary Search - Selection Sort - Insertion Sort - Merge Sort - Histogram.

UNIT IV FUNCTIONS, MODULES AND PACKAGES 9

Functions - Function Definition and Use - Flow of Execution - Parameters and Arguments - Fruitful Functions: Return values - Parameters - Local and Global Scope - Function Composition - Recursion - Modules – from-import Statement

- Name of Module - Making your own modules - Packages - Standard Library Modules - `globals()`, `locals()` and `reload()` - Illustrative programs: Fibonacci Series using functions - Arithmetic Operations using Module - Area of different shapes using Packages.

UNIT V CLASSES, OBJECTS AND EXCEPTION HANDLING

9

Classes and Objects - Defining Classes - Creating Objects - Data Abstraction and Hiding through Classes - `init()` method - Class Variables and Object Variables - Introduction to Errors and Exception Handling - Handling Exceptions - Multiple Except Blocks - else Clause - Raising Exceptions - Built-in and User-defined Exceptions - Finally Block.

LIST OF EXPERIMENTS

15

1. Write a Python program to perform
 - a. Linear Search
 - b. Binary Search
2. Write a Python program to perform Selection Sort.
3. Write a Python program to sort the given numbers using Insertion Sort.
4. Write a Python program to do sorting using Merge sort.
5. Write a Python program to find first n prime numbers.
6. Write a Python program to Multiply two matrices.
7. Write a Python program to create Student class and instantiate its Object.
8. Write a Python License verification process using Exception handling.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. ReemaThareja. "Python Programming Using Problem Solving Approach", Oxford University Press 2018.
2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd edition, Updated for Python 3, 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. John V Guttag, "Introduction to Computation and Programming Using Python", Revised and expanded Edition, MIT Press, 2013.
3. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-Disciplinary Approach", Pearson India Education Services Pvt. Ltd., 2016.

4. Timothy A. Budd, "Exploring Python", Mc-Graw Hill Education (India) Private Ltd., 2015.
5. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012.
6. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem-Solving Focus", Wiley India Edition, 2013.
7. Paul Gries, Jennifer Campbell and Jason Montojo, "Practical Programming: An Introduction to Computer Science using Python 3", Second edition, Pragmatic Programmers, LLC, 2013.

WEB REFERENCES:

1. <http://greenteapress.com/wp/think-python/>
2. www.docs.python.org
3. <https://nptel.ac.in/courses/106/106/106106182/>

OUTCOMES:

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

1. Describe the syntax, semantics and control flow statements of Python programming. (K2)
2. Implement simple programs using control structures in Python. (K3)
3. Explain the methods to create and manipulate strings, lists, dictionaries, tuples and sets. (K2)
4. Articulate the concepts of functions, modules and packages in Python. (K2)
5. Implement simple programs using Python Data types and functions. (K3)
6. Apply the concepts of Exception handling, classes and objects. (K3)

CO - PO, MAPPING :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | - | 1 | 2 | 1 | 2 | - | - | - | 1 | - | 3 | 3 |
| CO2 | 1 | 2 | 3 | 3 | 3 | 2 | 1 | 1 | 1 | 1 | 1 | 3 |
| CO3 | - | 1 | 3 | 3 | 2 | 1 | - | - | - | - | 1 | 3 |
| CO4 | 1 | 2 | 3 | 3 | 2 | - | - | - | - | - | 1 | 3 |
| CO5 | 2 | 3 | 3 | 3 | 3 | 1 | 1 | 2 | 2 | 1 | 2 | 3 |
| CO6 | 2 | 3 | 3 | 3 | 3 | 1 | 1 | 2 | 2 | 1 | 2 | 3 |

SEMESTER - II

| | | | | | |
|-------------------------------|--------------------------------------|----------|----------|----------|----------|
| 20BSPH201 SDG NO. 4 | PHYSICS OF ELECTRONIC DEVICES | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To acquaint the electrical properties of materials.
- To present the principles of semiconductor physics and its applications.
- To educate the properties of magnetic and dielectric materials and their uses.
- To introduce the bipolar junction transistors.
- To explicit the field effect transistors, power and display devices.

UNIT I ELECTRICAL PROPERTIES OF MATERIALS 9

Classical free electron theory - Expression for electrical conductivity - Thermal conductivity expression - Wiedemann-Franz law - Success and failures - electrons in metals - Particle in a three dimensional box - degenerate states - Fermi- Dirac statistics - Density of energy states - Electron in periodic potential- Energy bands in solids - Tight binding approximation - Electron effective mass- concept of hole.

UNIT II SEMICONDUCTOR DIODES 9

Semiconductors - Intrinsic, Extrinsic semiconductor, Carrier concentration, PN junction diode- Current equations, Energy Band diagram, Diffusion and drift current densities, forward and reverse bias characteristics, Transition and Diffusion Capacitances, Switching Characteristics, Breakdown in PN Junction Diodes, Special purpose diodes - Schottky barrier diode, Zener diode, Varactor diode, Tunnel diode, LASER diode and LDR.

UNIT III MAGNETIC AND DIELECTRIC PROPERTIES OF MATERIALS 9

Magnetism in materials - magnetic field and induction - magnetization - magnetic permeability and susceptibility - types of magnetic materials - microscopic classification of magnetic materials - Ferromagnetism: origin and exchange interaction - saturation magnetization and Curie temperature - Domain Theory - Hysteresis phenomenon - Ferrites. Dielectric materials: Polarization processes - dielectric loss - internal field - Clausius-Mosotti relation - dielectric breakdown.

UNIT IV BIPOLAR JUNCTION TRANSISTOR**9**

NPN -PNP -Operations-Early effect-Current equations – Input and Output characteristics of CE, CB, CC - Hybrid - π model - h-parameter model, Ebers Moll Model- Gummel Poon- model, Multi Emitter Transistor.

UNIT V FIELD EFFECT TRANSISTORS, POWER AND DISPLAY DEVICES 9

JFETs – Drain and Transfer characteristics,-Current equations-Pinch off voltage and its significance- MOSFET- Characteristics- Threshold voltage - Channel length modulation, D- MOSFET, E-MOSFET- Characteristics – Comparison of MOSFET with JFET.Power Devices-UJT, SCR, Diac, Triac, Display Devices-LED, LCD, Photo transistor, Opto Coupler, Solar cell, CCD.

TOTAL: 45 PERIODS**TEXT BOOKS:**

1. Donald A Neaman, “Semi-conductor Physics and Devices”, Fourth Edition, TataMcGrawHill Inc.2012.
2. Salivahanan.S, Suresh Kumar. N, Vallavaraj.A, “Electronic Devices and circuits”, Third Edition, Tata McGraw- Hill,2008.

REFERENCES:

1. Robert Boylestadand Louis Nashelsky, “Electron Devices and Circuit Theory”, Pearson Prentice Hall, 10th edition, July2008.
2. R.S.Sedha, “A Text Book of Applied Electronics” S.Chand Publications, 2006.
3. Yang, “Fundamentals of Semiconductor Devices”, McGraw Hill International Edition, 1978.

OUTCOMES:**Upon completion of the course, the student should be able to**

1. Understand the electrical properties of materials. (K1)
2. Analyze the principles of semiconductor physics and its applications. (K2)
3. Explore the properties of magnetic and dielectric materials and their uses. (K2)
4. Understand the theory, construction and operation of the bipolar junction transistors. (K3)
5. Analyse the concept of field effect transistors, power and display devices (K2)
6. Learn the concepts of Physics towards engineering applications.(K1)

CO - PO, PSO MAPPING

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| C01 | 3 | 3 | 2 | 1 | 2 | 1 | 1 | - | 3 | - | - | 1 | 2 | - |
| C02 | 3 | 2 | 3 | 2 | 3 | 1 | 1 | - | 1 | 1 | - | 1 | 3 | - |
| C03 | 3 | 2 | 3 | 3 | 3 | 1 | 1 | - | 1 | - | - | 1 | 3 | - |
| C04 | 1 | 1 | 3 | 1 | - | - | 1 | - | 2 | - | - | - | 2 | - |
| C05 | 2 | 2 | 1 | 2 | 3 | - | 1 | - | 2 | - | - | 1 | 2 | - |
| C06 | 3 | 3 | 2 | 1 | 2 | 2 | 1 | - | 2 | - | - | 1 | 2 | - |

SEMESTER - II

| | | | | | |
|----------------------------------|--|----------|----------|----------|----------|
| 20BSCY201 SDG NO. 4,17 | ENVIRONMENTAL SCIENCE AND ENGINEERING | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To study the nature and facts about environment
- To find and implement scientific, technological, economic and political solutions to environmental problems
- To study the interrelationship between living organism and environment
- To provide the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.
-

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY**10**

Definition, scope and importance of environment – need for public awareness – Ecosystem: concept of an ecosystem – structure and functions of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – food chains, food webs and ecological pyramids – ecological succession. Introduction to biodiversity definition: genetic, species and ecosystem diversity – values of biodiversity. Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity – man-wildlife conflicts – endangered and endemic species of India. Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds; Field study of simple ecosystems – pond, river, hill slopes, etc.

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 – role of an individual in prevention of pollution – pollution case studies. Disaster management: floods, earthquake, cyclone and landslides – nuclear accidents and holocaust – case studies. Field study of local polluted site – Urban / Rural / Industrial /Agricultural.

UNIT III NATURAL RESOURCES**9**

Forest resources: Use and over – exploitation, deforestation, case studies – Water resources: Use and over- utilization of surface and ground water – dams-benefits and problems, conflicts over water – Mineral resources: Environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, case studies – Energy resources: Growing energy needs, use of alternate energy sources - renewable and non renewable energy sources – Land resources: land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

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

From unsustainable to sustainable development – Sustainable Development Goals – Water conservation: rain water harvesting, watershed management – Climate change: global warming, chemical and photochemical reactions in the atmosphere – acid rain, ozone layer depletion – environmental ethics: Issues and possible solutions – 12 Principles of green chemistry – Environmental Legislation & Laws: Environment (Protection) Act – 1986 Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – The Biomedical Waste (Management and Handling) Rules; 1998 and amendments - scheme of labelling of environmentally friendly products (Ecomark) – Issues involved in enforcement of environmental legislation - central and state pollution control boards, role of non-governmental organization – Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT**8**

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value

education – HIV / AIDS – women and child welfare – Environmental Impact Assessment(EIA) - role of information technology in environment and human health – Case studies.

TOTAL: 45 PERIODS

TEXTBOOKS:

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. Dharmendra S. Sengar, “Environmental law”, Prentice hall of India Pvt Ltd, New Delhi, 2007.
2. Erach Bharucha, “Textbook of Environmental Studies”, Universities Press(I) Pvt Ltd., Hydrabad, 2015.
3. G. Tyler Miller and Scott E. Spoolman, “Environmental Science”, Cengage Learning India Pvt. Ltd., Delhi, 2014.
4. Rajagopalan. R, “Environmental Studies-From Crisis to Cure”, Oxford University Press, 2005.

OUTCOMES:

Upon successful completion of this course, student should be able to

1. Understand the relationship between the environment and human activities to maintain the ecological balance. (K1)
2. Identify societal issues and implement suitable technological solutions to eradicate. (K3)
3. Acquire skills for scientific problem solving related to environmental pollution and Disaster Management. (K3)
4. Disseminate the need for the natural resources and its application to meet the modern requirements. (K2)
5. Aware of environmental issues and Protection Acts to achieve the Sustainable Development Goals. (K2)
6. Recognize the need for population control measures and the environmental based value.education concepts for attaining an eco-friendly environment. (K2)

CO - PO MAPPING:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | 1 | 1 | - | - | - | 1 | 2 | - | 1 | 1 | - | 2 |
| CO2 | 2 | 2 | 2 | - | 2 | 2 | 3 | 1 | 2 | 2 | - | 2 |
| CO3 | 1 | 1 | 1 | 1 | - | 1 | 1 | - | 1 | 2 | - | 1 |
| CO4 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | - | 1 | 1 | 1 | 1 |
| CO5 | 2 | 2 | 1 | - | - | 1 | 1 | - | - | - | 1 | - |
| CO6 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

SEMESTER - II

| | | | | | |
|------------------------------------|---|----------|----------|----------|------------|
| 20ESGE201 SDG NO. 4,9,12 | ENGINEERING PRACTICES LABORATORY | L | T | P | C |
| | | 0 | 0 | 3 | 1.5 |

OBJECTIVES:

- To provide exposure to the students with hands on experience on various basic engineering practices in Electrical and Electronics Engineering, Civil and Mechanical Engineering

ELECTRICAL ENGINEERING PRACTICE

- Residential house wiring using switches, fuse, indicator, lamp and energy meter.
- Fluorescent lamp wiring.
- Stair case wiring.
- Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
- Measurement of energy using single phase energy meter.
- Measurement of resistance to earth of electrical equipment.

ELECTRONICS ENGINEERING PRACTICE

- Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CRO.
- Study of logic gates AND, OR, EX-OR and NOT.
- Generation of Clock Signal.

4. Soldering practice – Components, Devices and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of HWR and FWR.

CIVIL ENGINEERING PRACTICE

Buildings: Study of plumbing and carpentry components of residential and industrial buildings, safety aspects.

Plumbing Works:

1. Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
2. Study of pipe connections requirements for pumps and turbines.
3. Preparation of plumbing line sketches for water supply and sewage works.
4. Hands-on-exercise: Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
5. Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Power Tools only:

1. Study of the joints in roofs, doors, windows and furniture.
2. Hands-on-exercise: Wood work, joints by sawing, planing and cutting.

MECHANICAL ENGINEERING PRACTICE

Welding:

1. Preparation of butt joints, lap joints and T- joints by Shielded metal arc welding.
2. Gas welding practice.

Basic Machining:

1. Simple Turning and Taper turning.
2. Drilling Practice.

Sheet Metal Work:

1. Forming & Bending.
2. Model making – Trays and funnels.
3. Different type of joints.

Machine assembly practice:

1. Study of centrifugal pump.
2. Study of air conditioner.

Demonstration on:

1. Smithy operations, upsetting, swaging, setting down and bending.
Example – Exercise – Production of hexagonal headed bolt.
2. Foundry operations like mould preparation for gear and step cone pulley.
3. Fitting – Exercises – Preparation of square fitting and V – fitting models.

Total : 45 PERIODS**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS****1. Electrical**

| | | |
|---|---|----------------|
| 1 | Assorted electrical components for house wiring | 15 Sets |
| 2 | Electrical measuring instruments | 10 Sets |
| 3 | Study purpose items: Iron box, fan and regulator, emergency lamp | 1 Each |
| 4 | Megger (250V/500V) | 1 No |
| 5 | Power Tools: Range Finder Digital Live-wire detector | 2 Nos 2 Nos |

2. Electronics

| | | |
|---|--|--------|
| 1 | Soldering guns | 10 Nos |
| 2 | Assorted electronic components for making circuits | 50 Nos |
| 3 | Small PCBs | 10 Nos |
| 4 | Multimeters | 10 Nos |

3. Civil

| | | |
|---|--|--|
| 1 | Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings. | 15 Sets |
| 2 | Carpentry vice (fitted to work bench) | 15 Nos |
| 3 | Standard woodworking tools | 15 Sets |
| 4 | Models of industrial trusses, door joints, furniture joints | 5 each |
| 5 | Power Tools: Rotary Hammer Demolition Hammer Circular Saw Planer Hand Drilling Machine Jigsaw | 2 Nos 2 Nos 2 Nos 2 Nos 2 Nos 2 Nos |

4. Mechanical

| | | |
|---|---|-------|
| 1 | Arc welding transformer with cables and holders | 5 Nos |
|---|---|-------|

| | | |
|---|---|--------|
| 2 | Welding booth with exhaust facility | 5 Nos |
| 3 | Welding accessories like welding shield, chipping hammer, wire brush, etc | 5 Sets |
| 4 | Oxygen and acetylene gas cylinders, blow pipe and other welding outfit. | 2 Nos |
| 5 | Centre lathe | 2 Nos |
| 6 | Hearth furnace, anvil and smithy tools | 2 Sets |
| 7 | Moulding table, foundry tools | 2 Sets |
| 8 | Power Tool: Angle Grinder | 2 Nos |
| 9 | Study-purpose items: centrifugal pump, air-conditioner | 1 each |

OUTCOMES:

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

1. Elaborate on the components, gates, soldering practices. Calculate electrical parameters such as voltage, current, resistance and power. (K1)
2. Design and implement Rectifier and Timer circuits (K2)
3. Measure the electrical energy by single phase and three phase energy meters. (K2)
4. Prepare the carpentry and plumbing joints. (K2)
5. Perform different types of welding joints and sheet metal works (K2)
6. Perform different machining operations in lathe and drilling. (K2)

CO - PO, PSO MAPPING:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | 3 | 2 | 1 | 1 | 2 | 1 | - | - | 1 | 1 | 1 | 1 |
| CO2 | 3 | 2 | 1 | 1 | 2 | 1 | - | - | 1 | 1 | 1 | 1 |
| CO3 | 2 | 2 | 1 | 1 | 1 | 1 | - | - | 1 | 1 | 1 | 1 |
| CO4 | 1 | 1 | 1 | - | - | 2 | - | - | 1 | 1 | 1 | 2 |
| CO5 | 2 | 1 | 1 | - | - | 1 | 1 | 1 | 1 | 1 | 1 | 2 |
| CO6 | 2 | 1 | 1 | - | - | 1 | - | 1 | 1 | 1 | 1 | 2 |

SEMESTER - II

| | | | | | |
|------------------|-----------------------------|----------|----------|----------|------------|
| 20ECPL201 | CIRCUITS AND DEVICES | L | T | P | C |
| SDG NO. 4 | LABORATORY | 0 | 0 | 3 | 1.5 |

OBJECTIVES:

- Analyse the characteristics of basic electronic devices
- Design RL and RC circuits
- Verify KVL & KCL, Thevinin, Norton and Super Position Theorems
- Verify Reciprocity and Maximum Power Transfer Theorem
- Analyse the characteristics of Wave shaping circuits and Rectifier

LIST OF EXPERIMENTS :

1. Characteristics of PN Junction Diode.
2. Zener diode Characteristics & Regulator using Zener diode .
3. Common Emitter input-output Characteristics.
4. Common Base input-output Characteristics.
5. FET Characteristics.
6. SCR Characteristics.
7. Clipper and Clamper & FWR.
8. Verifications of Thevinin & Norton theorem.
9. Verifications of KVL & KCL.
10. Verifications of Super Position Theorem.
11. Verifications of maximum power transfer & reciprocity theorem.
12. Determination of Resonance Frequency of Series & Parallel RLC Circuits.

TOTAL: 45 PERIODS

LAB REQUIREMENT FOR A BATCH OF 30 STUDENTS / 2 STUDENTS PER EXPERIMENT:

S.No. EQUIPMENTS

- | | | |
|----|----------------------------------|-------------------------|
| 1. | BC 107, BC 148, 2N2646, BFW10 | - 25 each |
| 2. | 1N4007, Zener diodes | - 25 each |
| 3. | Resistors, Capacitors, Inductors | - sufficient quantities |
| 4. | Bread Boards | - 15 Nos |
| 5. | CRO (30MHz) | - 10 Nos |
| 6. | Function Generators (3MHz) | - 10 Nos |

OUTCOMES:

On completion of this laboratory course, the student should be able to

1. Analyze the characteristics of basic electronic devices. (K4)
2. Design RL and RC circuits. (K5)
3. Verify Thevenin & Norton theorem KVL & KCL, and Super Position Theorems. (K6)
4. Test the performance of clipper and clamper & FWR. (K6)
5. Analyze the characteristics of basic electronic devices such as Diode, BJT, FET and SCR. (K4)
6. Examine the input-output characteristics of CE and CB amplifiers. (K3)

CO - PO, PSO MAPPING :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 3 | 1 | 3 | 1 | - | - | - | - | - | 2 | 3 | 3 | 2 |
| CO2 | 3 | 3 | 1 | 3 | 1 | - | - | - | - | - | 2 | 3 | 3 | 2 |
| CO3 | 3 | 3 | 1 | 3 | 1 | - | - | - | - | - | 2 | 3 | 3 | 2 |
| CO4 | 3 | 3 | 1 | 3 | 1 | - | - | - | - | - | 2 | 3 | 3 | 2 |
| CO5 | 3 | 3 | 1 | 3 | 1 | - | - | - | - | - | 2 | 3 | 3 | 2 |
| CO6 | 3 | 3 | 1 | 3 | 1 | - | - | - | - | - | 2 | 3 | 3 | 2 |

SEMESTER - II

| | | | | | |
|------------------------|------------|---|---|---|---|
| 20ECTE201 SDG NO. 9 | PCB DESIGN | L | T | P | C |
| | | 0 | 0 | 2 | 1 |

OBJECTIVES:

- Analyze and interpret test results and measurements on electric circuits
- To predict the performance of electric circuits from device characteristics
- Design an electronic printed circuit board for a specific application using industry standard software

LIST OF EXPERIMENTS :

1. Introduction to PCB and OrCAD software.
2. Designing of schematic.
3. Designing of capture from OrCAD and getting positive for PCB manufacturing.

- Soldering shop: Fabrication of DC regulated power supply.
- PCB Lab: (a) Artwork & printing of a simple PCB. (b) Etching & drilling of PCB.
- Wiring & fitting shop: Fitting of power supply along with a meter in cabinet.
- Testing of regulated power supply fabricated.

TOTAL: 30 PERIODS

**LAB REQUIREMENT FOR A BATCH OF 30 STUDENTS /
2 STUDENTS PER EXPERIMENT:**

S.No. EQUIPMENTS

| | | |
|----|--|--------------|
| 1. | Copper clad base board | -15 Nos. |
| 2. | Hand Drilling machine | -15 Nos. |
| 3. | Soldering guns | -15 Nos. |
| 4. | Assorted electronic components for making circuits | -50 Nos. |
| 5. | OrCAD software | (15 users) |
| 6. | Copper solvent | -as required |
| 7. | PCs - 15 Nos | -15 Nos. |

OUTCOMES:

On completion of this course, the student should be able to

- Analyze the fabrication processes of printed circuit boards.
- Perform the chemical processes by using negative/positive masks.
- Perform the mechanical processes by using drilling, etching/routing, milling equipments as well as the developer and etcher machines.
- Operate ORCAD software and design the PCB using ORCAD software.
- Fabricate and test the PCB for regulated power supply.

CO - PO, PSO MAPPING:

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

SEMESTER - II

| | | | | | |
|---------------------------------|--------------------------|----------|----------|----------|----------|
| 20TPHS201 SDG NO. 4&5 | SKILL ENHANCEMENT | L | T | P | C |
| | | 0 | 0 | 2 | 1 |

OBJECTIVES:

- To understand the nuances in resume building
- To explore various virtual meeting tools
- To gain knowledge about online certification courses
- To develop knowledge in Google Suite products
- To enhance presentation skills

UNIT I RESUME BUILDING

6

Your Strength, Projects, Internship, Paper Presentation, uploading your coding in github, Introduction to HackerRank, HackerEarth virtual online assessment (Auto Proctored) (Practicals - Construct a resume, Register for a online Mock Assessment / Contest)

UNIT II VIRTUAL MEETINGS

6

Basic Etiquette of virtual meeting - Introduction to Skype - Zoom - Webex - Google Meet - Gotowebinar - Jio meet - Screen Share - Jamboard - Feedback polling - Chatbox
(Practicals - Accept and Register for a mock class to attend - How to host a meeting).

UNIT III ONLINE LEARNING

6

Online Certification - Coursera - Udemy - Edx - Cisco - Online Practice Platforms - SkillRack - Myslate - FACEprep - BYTS - aptimithra - Contest Registrations - TCS Campus Commune - HackwithInfy, InfyTQ - Virtusa NurualHack - Mindtree Osmosis - Online assessment - AMCAT-PGPA.
(Practicals - Campus Commune Registration, Coursera registration - Mock Registration (KAAR Technologies as sample).

UNIT IV GOOGLESUITE

8

Define google suite - Benefits of google suite - Google Search - Sheet - Docs - Forms - Calender - Drive - Slide - Translate - Duo - Earch - Maps - Hangouts- Sites - Books - Blogger
(Practicals - Create google sheets and share - Create google Forms and share, Create Google Slide and share, Google drive creation and share (Knowledge of Rights), Create poll and share.

UNIT V PRESENTATION SKILLS

Email Writing – Group Discussion - Power Point Presentation

(Practicals- Create a self SWOT Analysis report. A PowerPoint Slide Preparation)

TOTAL : 30 PERIODS

WEB REFERENCES :**Unit I: Resume Building:**

1. <https://zety.com/blog/resume-tips>
2. <https://resumegenius.com/blog/resume-help/how-to-write-a-resume>
3. <https://www.hackerearth.com/recruit/>
4. <https://www.hackerrank.com/about-us>

Unit – II:Virtual Meetings

1. <https://www.claphamschool.org/our-community/blog/online-learning-etiquette-guide-14-principles-to-guide-students>
2. https://online.hbs.edu/blog/post/virtual-interview-tips?c1=GAW_SE_NW&source=IN_GEN_DSA&cr2=search__-__nw__-__in__-__dsa__-__general&kw=dsa__-__general&cr5=459341920955&cr7=c&gclid=Cj0KCQjw8fr7BRDSARIsAK0Qqr4dRRbboL3kltrwDsr7hm8oIHtN5dfjD3NIFZULuzNwEXxhjpNFQ2caApn5EALw_wcB
3. <https://hygger.io/blog/top-10-best-group-meeting-apps-business/>
4. <https://www.zdnet.com/article/best-video-conferencing-software-and-services-for-business/>

Unit – III:Online Learning

1. <https://www.coursera.org/browse>
2. <https://support.udemy.com/hc/en-us/articles/229603868-Certificate-of-Completion>
3. <https://www.edx.org/course/how-to-learn-online>
4. <https://www.cisco.com/c/en/us/training-events/training-certifications/certifications.html>
5. <https://campuscommune.tcs.com/en-in/intro>
6. <https://www.freshersnow.com/tcs-campus-commune-registration/>
7. <https://www.infosys.com/careers/hackwithinfy.html>
8. <https://www.mindtree.com/blog/osmosis-2013-my-experiences>
9. <https://www.myamcat.com/knowning-amcat>
10. <https://www.admitkard.com/blog/2020/02/06/amcat/>

Unit IV: Google Suite

1. <https://www.inmotionhosting.com/blog/what-is-g-suite-and-why-should-i-consider-using-it/>
2. https://en.wikipedia.org/wiki/G_Suite
3. <https://blog.hubspot.com/marketing/google-suite>
4. <https://kinsta.com/blog/g-suite/>

Unit V: Presentation Skills

1. <https://www.mindtools.com/CommSkll/EmailCommunication.htm>
2. <https://www.grammarly.com/blog/email-writing-tips/>
3. <https://business.tutsplus.com/articles/how-to-write-a-formal-email--cms-29793>
4. <https://www.softwaretestinghelp.com/how-to-crack-the-gd/>
5. <https://www.mbauniverse.com/group-discussion/tips>
6. <https://slidemodel.com/23-powerpoint-presentation-tips-creating-engaging-interactive-presentations/>
7. <https://business.tutsplus.com/articles/37-effective-powerpoint-presentation-tips--cms-25421>
8. <https://blog.prezi.com/9-tips-on-how-to-make-a-presentation-a-success/>
9. <http://www.garreynolds.com/preso-tips/design/>

OUTCOMES:**On completion of this course, the student should be able to**

1. Construct a suitable resume and registration procedure for online mock assessments. (K1)
2. Handle various virtual meeting tools. (K3)
3. Acquire exposure about online certification courses. (K4)
4. Get involved and work in a collaborative manner. (K2)
5. Gain knowledge in various presentation methodologies. (K1)
6. Apply knowledge to practice Google suite features and SWOT analysis. (K3)

CO – PO MAPPING

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | - | - | - | - | 3 | 2 | - | 3 | 2 | 3 | - | 2 |
| CO2 | - | - | - | - | 3 | 2 | - | 3 | 2 | 3 | - | 2 |
| CO3 | - | - | - | - | 3 | 2 | - | - | 1 | 3 | - | 2 |
| CO4 | - | - | - | - | 3 | 2 | - | 3 | 3 | 3 | - | 2 |
| CO5 | - | - | - | - | 3 | 2 | - | - | 2 | 3 | - | 2 |
| CO6 | - | - | - | - | 3 | 2 | - | - | 2 | 3 | - | 2 |

SEMESTER - II

| | | | | | |
|--|-----------------------------|----------|----------|----------|----------|
| 20HSMG201 SDG NO. 4 & 5 | INTERPERSONAL VALUES | L | T | P | C |
| | | 2 | 0 | 0 | 0 |

OBJECTIVES:

- Values through Practical activities

UNIT I INTERPERSONAL VALUES**6**

Interpersonal Relationships and Values – Importance and Barriers – Building and maintain relationships – Mutual understanding – Respect to others.

UNIT II EFFECTIVE COMMUNICATION**6**

Communication skills –Importance and Barriers - Impressive formation and management – Public speaking

UNIT III GROUP DYNAMICS**6**

Group formation –Teamwork – Identify others attitude and behaviour – Formation of relationship – Personal and professional.

UNIT IV MUTUAL RELATIONSHIP**6**

Building mutual understanding and cooperation – Enhancing decision making skills – Problem solving skills – Comparative Appraisal – Interpersonal needs.

UNIT V POSITIVE ATTITUDE

Fostering trust and cooperation – Developing and maintain positive attitude –
Improving socialization – Development of security and comfort.

TOTAL: 30 PERIODS

Note: Each topic in all the above units will be supplemented by practice exercises and classroom activities and projects.

REFERENCE BOOKS:

1. Barun K. Mitra, "Personality Development and Soft Skills", Oxford University Press, 2016.
2. B.N.Ghosh, "Managing Soft Skills for Personality Development", McGraw Hill India, 2012.

OUTCOMES:

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

1. Develop a healthy relationship & harmony with others. (K1)
2. Practice respecting every human being. (K3)
3. Practice to eradicate negative temperaments. (K3)
4. Acquire Respect, Honesty, Empathy, Forgiveness and Equality. (K4)
5. Manage the cognitive abilities of an Individual. (K5)
6. Understanding the importance of public speaking and teamwork. (K2)

CO – PO MAPPING :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | - | - | - | - | - | 2 | 2 | 3 | 3 | 1 | 1 | 1 |
| CO2 | - | - | - | - | - | 2 | 2 | 3 | 3 | 1 | 1 | 1 |
| CO3 | - | - | - | - | - | 2 | 2 | 3 | 3 | 1 | 1 | 1 |
| CO4 | - | - | - | - | - | 2 | 2 | 3 | 3 | 1 | 1 | 1 |
| CO5 | - | - | - | - | - | 2 | 2 | 3 | 3 | 1 | 1 | 1 |
| CO6 | - | - | - | - | - | 2 | 2 | 3 | 3 | 1 | 1 | 1 |

SEMESTER - III

| | | | | | |
|-------------------------------|------------------------|----------|----------|----------|----------|
| 20ITPC301 SDG NO. 4 | DATA STRUCTURES | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To understand the concepts of ADT's
- To learn Linear Data Structures – Lists, Stacks, and Queues
- To understand Sorting, Searching and Hashing Algorithms
- To learn Dynamic Data Structures - Tree and Graph

UNIT I LINEAR DATA STRUCTURES – I 9

Stacks and Queues : Abstract Data Types (ADTs) – 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 II LINEAR DATA STRUCTURES – II 9

Linked List: 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 III NON LINEAR DATA STRUCTURES – I 9

Trees : 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 -Heap – Applications of Heap.

UNIT IV NON LINEAR DATA STRUCTURES – II 9

Graphs : Definition – Representation of Graph – Types of Graph – Breadth First Traversal –Depth First Traversal – Topological Sort – Bi-Connectivity – Cut Vertex – Euler Circuits – Dijkstra"s algorithm – Bellman-Ford algorithm – Floyd's Algorithm - minimum spanning tree – Prim's and Kruskal's algorithms – 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

TEXT BOOKS:

1. M. A. Weiss, "Data Structures and Algorithm Analysis in C", Pearson Education Asia, 2002.
2. Reema Thareja, "Data Structures Using C", Second Edition, Oxford University Press, 2011.

REFERENCES:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", Second Edition, Mcgraw Hill, 2002.
2. Stephen G. Kochan, "Programming in C", 3rd edition, Pearson Education.
3. Aho, Hopcroft and Ullman, "Data Structures and Algorithms", Pearson Education, 1983.
4. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, "Fundamentals of Data Structures in C", Second Edition, University Press, 2008.

WEB REFERENCES:

1. <https://www.programiz.com/dsa>
2. <http://masterraghu.com/subjects/Datastructures/ebooks/remathareja.pdf>

OUTCOMES:**Upon completion of the course, the student should be able to**

1. Implement abstract data types for linear data structures. (K3)
2. Implement abstract data types for non-linear data structure. (K3)
3. Apply the different linear and non-linear data structures to problem solutions. (K3)
4. Implement the various sorting and searching algorithms. (K3)
5. Solve Problem involving Graph, Trees and Heap. (K3)
6. Choose appropriate data structures to solve real world problems efficiently. (K3)

CO – PO, PSO MAPPING:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 2 | 2 | 1 | 2 | 1 | 1 | 1 | 0 | 2 | 2 | 3 | 3 | 1 | 1 |
| CO2 | 2 | 2 | 1 | 2 | 1 | 1 | 1 | 0 | 2 | 2 | 3 | 3 | 1 | 1 |
| CO3 | 3 | 3 | 2 | 3 | 3 | 1 | 1 | 1 | 2 | 2 | 3 | 3 | 1 | 1 |
| CO4 | 2 | 2 | 1 | 2 | 3 | 2 | 1 | 0 | 1 | 1 | 2 | 1 | 1 | 2 |
| CO5 | 2 | 2 | 1 | 2 | 3 | 0 | 0 | 1 | 2 | 1 | 2 | 2 | 1 | 2 |
| CO6 | 3 | 3 | 3 | 3 | 1 | 0 | 0 | 0 | 1 | 1 | 2 | 1 | 2 | 2 |

SEMESTER - III

| | | | | | |
|-----------------------------------|---|----------|----------|----------|----------|
| 20CCPC301 SDG NO. 4 & 9 | DIGITAL LOGICS AND SYSTEM DESIGN | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To study various number systems and simplify the logical expressions using Boolean functions.
- To study combinational circuits.
- To design various synchronous and asynchronous circuits.
- To introduce asynchronous sequential circuits and PLDs
- To introduce digital simulation for development of application oriented logic circuits.

UNIT I NUMBER SYSTEMS AND DIGITAL LOGIC FAMILIES 9

Review of number systems, binary codes, error detection and correction codes (Parity and Hamming code) – Digital Logic Families -comparison of RTL, DTL, TTL, ECL and MOS families -operation, characteristics of digital logic family.

UNIT II COMBINATIONAL CIRCUITS 9

Combinational logic – representation of logic functions-SOP and POS forms, K-map representations – minimization using K maps – simplification and implementation of combinational logic – multiplexers and de multiplexers – code converters, adders, subtractors, Encoders and Decoders

UNIT III SYNCHRONOUS SEQUENTIAL CIRCUITS 9

Sequential logic- SR, JK, D and T flip flops – level triggering and edge triggering – counters asynchronous and synchronous type – Modulo counters – Shift registers – design of synchronous sequential circuits – Moore and Melay models- Counters, state diagram; state reduction; state assignment.

UNIT IV ASYNCHRONOUS SEQUENTIAL CIRCUITS AND PROGRAMMABILITY LOGIC DEVICES 9

Asynchronous sequential logic circuits-Transition table, flow table-race conditions, hazards & errors in digital circuits; analysis of asynchronous sequential logic circuits introduction to Programmability Logic Devices: PROM – PLA –PAL, CPLD-FPGA.

UNIT V INTRODUCTION TO VERILOG HDL 9

Structure of Verilog module, Operators, data types, Styles of description- Data flow description, Behavioral description, Implement logic gates,

Combinational circuits using Verilog data flow description.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Morris Mano and Michael D. Ciletti, "Digital Design", 5th edition, Prentice Hall of India, 2012 (Unit I – IV)
2. Samir Palnitkar, "Verilog HDL", 2nd Edition, Pearson Education, 2003 (Unit V)

REFERENCES:

1. Mandal, Digital Electronics Principles and Application, McGraw Hill Edu, 2013.
2. Thomas L. Floyd, Digital Fundamentals, 11th edition, Pearson Education, 2015.
3. D.P. Kothari, J.S. Dhillon, Digital circuits and Design, Pearson Education, 2016.
4. J Bhasker, "Verilog Hdl Primer", 3rd Edition, Bs Publications, 2015.

WEB REFERENCES:

1. https://swayam.gov.in/nd1_noc19_ee51/preview
2. <https://nptel.ac.in/courses/117106086/>
3. https://www.researchgate.net/publication/224645209_Online_Development_of_Digital_Logic_Design_Course

ONLINE RESOURCES:

1. <https://www.udemy.com/course/digital-electronics-logic-design/>
2. <https://www.intel.com/content/www/us/en/programmable/support/training/course/ohdl1120.html>

OUTCOMES:

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

1. Analyze the Number Systems, Error Correction and Detection codes and Digital Logic Families (K4).
2. Design the Combinational Circuits using Reduction Techniques like Boolean laws and theorems, K-map. (K5)
3. Develop and Stimulate the VERILOG code for digital circuits (K6)
4. Analyze and Design Synchronous Sequential digital circuits. (K4)
5. Design of Asynchronous Sequential digital circuits. (K5)
6. Apply the logic Functions in PLA, PAL, PROM, CPLD & FPGA. (K3)

CO- PO,PSO MAPPING:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| C01 | 3 | 3 | 2 | - | 2 | - | - | - | - | 1 | 1 | 3 | 2 | 2 |
| C02 | 3 | 3 | 3 | 1 | 2 | - | - | - | - | 2 | 2 | 3 | 2 | 2 |
| C03 | 3 | 3 | - | 1 | 3 | - | 1 | 1 | 1 | 2 | 3 | 3 | 3 | 2 |
| C04 | 3 | 3 | 3 | 1 | 2 | - | - | - | - | 2 | 2 | 3 | 2 | 2 |
| C05 | 3 | 3 | 2 | 1 | 2 | - | - | - | - | 2 | 2 | 2 | 2 | 2 |
| C06 | 3 | 2 | - | - | 1 | - | 1 | 1 | - | 1 | 2 | 3 | 2 | 2 |

SEMESTER - III

| | | | | | |
|-----------------------------------|----------------------------|----------|----------|----------|----------|
| 20EPC303 SDG NO. 3,4,11 | SIGNALS AND SYSTEMS | L | T | P | C |
| | | 3 | 1 | 0 | 4 |

OBJECTIVES:

- To understand the fundamentals and properties of signal & systems
- To know the methods of characterization of LTI systems in time domain and frequency domain
- To analyze continuous time signals and system using Fourier and Laplace transforms
- To analyze discrete time signals and system using Fourier and Z transforms
- To analyze analog and discrete time systems, connected in series and parallel

UNIT I CLASSIFICATION OF SIGNALS AND SYSTEMS**9**

Standard signals- Step, Ramp, Pulse, Impulse, Real and complex exponentials and Sinusoids_ Representation of Continuous and discrete time signals, Classification of signals – Continuous time (CT) and Discrete Time (DT) signals, Periodic & Aperiodic signals, Deterministic & Random signals, Energy & Power signals - Classification of systems-CT systems and DT systems- – Linear & Nonlinear, Time-variant & Time-invariant, Causal & Non-causal, Stable & Unstable.

UNIT II ANALYSIS OF CONTINUOUS TIME SIGNALS**9**

Fourier series representation of continuous time periodic signals - properties

of continuous time Fourier series, Fourier Transform of continuous time aperiodic signals and periodic signals, properties of continuous time Fourier transform - Laplace Transforms and properties.

UNIT III LINEAR TIME INVARIANT CONTINUOUS TIME SYSTEMS 9

Impulse response - convolution integrals- Properties of continuous time LTI system - Differential Equation- Causal continuous time LTI system described by differential equations -Fourier and Laplace transforms in Analysis of CT systems - Systems connected in series / parallel.

UNIT IV ANALYSIS OF DISCRETE TIME SIGNALS 9

Baseband signal Sampling – properties of discrete time LTI system, Causal discrete time LTI system described by difference equations. Fourier series representation of discrete time periodic signals, properties of discrete time Fourier series, Fourier Transform of discrete time signals (DTFT) – Properties of DTFT - Z Transform & Properties.

UNIT V LINEAR TIME INVARIANT-DISCRETE TIME SYSTEMS 9

Impulse response – Difference equations-Convolution sum-Discrete Fourier Transform and Z Transform Analysis of Recursive & Non-Recursive systems-DT systems connected in series and parallel.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Allan V.Oppenheim, S.Wilsky and S.H.Nawab, “Signals and Systems”, Pearson, 2015. (Unit 1- V).

REFERENCES:

1. B. P. Lathi, “Principles of Linear Systems and Signals”, Second Edition, Oxford, 2009.
2. R.E.Zeimer, W.H.Tranter and R.D.Fannin, “Signals & Systems - Continuous and Discrete”, Pearson, 2007.
3. John Alan Stuller, “An Introduction to Signals and Systems”, Thomson, 2007.

WEB REFERENCES:

1. https://www.tutorialspoint.com/signals_and_systems/index.htm

ONLINE RESOURCES:

1. <https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring->

2011/lecture-notes/

2. <https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/assignments/>

OUTCOMES:

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

1. Classify the signals and systems. (K2)
2. Represent signals in the time domain and frequency domain. (K3)
3. Determine the Fourier/ Laplace of functions using the fundamental formulae and using their properties for continuous time functions.(K3)
4. Compute the response of the LTI system in the time domain and frequency domain. (K3)
5. Convert Continuous time signals to discrete time signals and determine Z transform using the fundamental formulae and using their properties for discrete time systems. (K2)
6. Realize systems in Direct form I / II or in parallel. (K3)

CO - PO, PSO MAPPING :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| C01 | 3 | 3 | 1 | 1 | 1 | - | - | - | - | - | - | - | 1 | 2 |
| C02 | 3 | 3 | 1 | - | - | - | - | - | - | - | - | - | 1 | 2 |
| C03 | 3 | 3 | 1 | 1 | - | - | - | - | - | - | - | - | 1 | 2 |
| C04 | 3 | 3 | 1 | 2 | 1 | - | - | - | - | - | - | - | 1 | 2 |
| C05 | 3 | 3 | 1 | - | 1 | - | - | - | - | - | - | - | 1 | 2 |
| C06 | 3 | 3 | 1 | 2 | - | - | - | - | - | - | - | - | 1 | 2 |

SEMESTER - III

| | | | | | |
|--|---|----------|----------|----------|----------|
| 20ITPC303 SDG NO. 4 & 9 | COMPUTER ORGANIZATION AND ARCHITECTURE | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To learn the basic structure and operations of a Computer
- To study the implementation of Fixed-Point and Floating Point Arithmetic unit
- To understand Parallelism and Multi-core processors using Pipelined execution
- To understand the Cache memories, Virtual memories and Communication of I/O devices

UNIT I BASIC STRUCTURE OF A COMPUTER SYSTEM 7

Functional Units – Basic Operational Concepts – Performance – Instructions: Language of the Computer – Operations, Operands – Instruction representation – Logical operations – Decision Making – MIPS Addressing.

UNIT II ARITHMETIC OPERATIONS IN PROCESSORS 11

Addition and Subtraction – Multiplication – Division – Floating Point Representation – Floating Point Operations – Subword Parallelism.

UNIT III PROCESSOR AND CONTROL UNIT 11

A Basic MIPS implementation – Building a Datapath – Control Implementation Scheme – Pipelining – Pipelined Datapath and Control – Handling Data Hazards & Control Hazards – Exceptions.

UNIT IV PARALLELISM 7

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

UNIT V MEMORY AND I/O SYSTEMS 9

Memory Hierarchy – memory technologies – Cache Memory – Measuring and Improving Cache Performance – Virtual Memory, TLB's – Accessing I/O Devices – Interrupts – Direct Memory Access – Bus structure – Bus Operation – Arbitration – Interface circuits – USB.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. David A. Patterson and John L. Hennessy, "Computer Organization and Design: The Hardware/Software Interface", Fifth Edition, Morgan Kaufmann / Elsevier, 2014.
2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky and Naraig Manjikian, "Computer Organization and Embedded Systems", Sixth Edition, Tata McGraw Hill, 2012.

REFERENCES:

1. William Stallings, "Computer Organization and Architecture – Designing for Performance", Eighth Edition, Pearson Education, 2010.
2. John P. Hayes, "Computer Architecture and Organization", Third Edition, Tata McGraw Hill, 2012.
3. John L. Hennessy and David A. Patterson, "Computer Architecture – A Quantitative Approach", Morgan Kaufmann / Elsevier Publishers, Fifth Edition, 2012.

WEB REFERENCES:

1. <https://nptel.ac.in/courses/106/106/106106147/>

OUTCOMES:**Upon completion of the course, the student should be able to**

1. Understand the physical and logical aspects of Computer System (K2)
2. Analyze the various parameters of the processor to improve system performance. (K4)
3. Evaluate the fixed and floating point arithmetic operations. (K5)
4. Design data path and control unit of computer system (K6)
5. Understand parallel processing architectures with pipelining and avoidance of hazards (K2)
6. Define the various components of computer system hardware (K1)

CO- PO, PSO MAPPING:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | 1 | 2 | 3 |
| CO2 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | 2 | 3 | 3 |
| CO3 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | 2 | 3 | 3 |
| CO4 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | 3 | 3 | 3 |
| CO5 | 3 | 1 | 1 | - | - | - | - | - | - | - | - | 3 | 3 | 3 |
| CO6 | 3 | 1 | 1 | - | - | - | - | - | - | - | - | 3 | 2 | 3 |

SEMESTER - III

| | | | | | |
|------------------|--|----------|----------|----------|----------|
| 20BSMA301 | LINEAR ALGEBRA, PARTIAL DIFFERENTIAL EQUATIONS AND TRANSFORMS | L | T | P | C |
| SDG NO. 4 | | 3 | 1 | 0 | 4 |

OBJECTIVES:

- The aim of this course is to impart knowledge in the concepts of linear algebra as a prerequisite for the recent thrust areas of technological advancement
- To know the importance of partial differential equations in modeling various engineering problems
- To introduce the techniques of Fourier and Z- Transforms to analyze continuous and discrete signals

UNIT I VECTOR SPACES

15

Vector spaces – Subspaces – Linear combinations– Linear independence and linear dependence – Bases and dimensions.

UNIT II LINEAR TRANSFORMATION AND INNER PRODUCT SPACES

15

Linear transformation - Null and range spaces - Dimension theorem (Statement only) - Matrix of a linear transformation - Inner product - norm - Gram Schmidt orthogonalization process.

UNIT III PARTIAL DIFFERENTIAL EQUATIONS

12

Formation of partial differential equations – Singular integrals - Solutions of standard types of first order partial differential equations - Lagrange's linear equation - Integral surface passing through a given curve - Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT IV FOURIER TRANSFORMS

9

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

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

TOTAL: 60 PERIODS

TEXTBOOKS:

1. Friedberg A.H., Insel A.J. and Spence L., "Linear Algebra", Prentice Hall of India, New Delhi, 2004. Unit I (Sec. 1.2, 1.3, 1.4 (linear combinations only), 1.5 & 1.6), Unit II (Sec. 2.1, 2.2, 6.1 & 6.2) (In Units I & II to include theorem statements only).
2. Veerarajan T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., 3rd Edition, New Delhi. Unit III (Sec. 1.2, 1.5, 1.7, 1.11, 1.13, 1.14), Unit IV (Sec. 4.1, 4.2, 4.3, 4.6), Unit V (Sec. 5.1, 5.2, 5.3, 5.4, 5.5).

REFERENCES:

1. Strang G., "Linear Algebra and its applications", Thomson (Brooks/Cole), New Delhi, 2005.
2. Lay D. C., "Linear Algebra and its Applications", 5th Edition, Pearson Education, 2015.
3. Kumaresan S., "Linear Algebra – A Geometric Approach", Prentice – Hall of India, New Delhi, Reprint, 2010.
4. James G., "Advanced Modern Engineering Mathematics", Pearson Education, 2007.

WEB RESOURCES

1. <https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/lecture-notes/>
2. <https://nptel.ac.in/courses/111/106/111106135/>
3. <https://nptel.ac.in/courses/111/103/111103021/>

ONLINE RESOURCES:

1. <https://www.khanacademy.org/math/linear-algebra>
2. <https://ocw.mit.edu/courses/mathematics/18-06-linear-algebra-spring-2010/video-lectures/>
3. <https://freevideolectures.com/course/3244/advanced-engineering-mathematics>

OUTCOMES:**Upon completion of the course, the students should be able to**

1. Determine the basis and dimension of a finite dimensional vector space. (K3)
2. Compute the Matrix, Range space and Null space of a linear transformation. (K3)
3. Construct orthonormal bases for inner product spaces using Gram Schmidt process. (K3)

4. Formulate and Solve Linear and non-linear Partial differential equations. (K3)
5. Find the Fourier transform, Inverse Fourier Transform, Fourier sine and cosine transforms of simple functions. (K3)
6. Apply Z-transforms to solve difference equations. (K3)

CO - PO, PSO MAPPING:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | 3 | 3 | 2 | 2 | 1 | - | - | - | - | - | - | 1 |
| CO2 | 3 | 3 | 2 | 2 | 1 | - | - | - | - | - | - | 1 |
| CO3 | 3 | 3 | 2 | 2 | 1 | - | - | - | - | - | - | 1 |
| CO4 | 3 | 3 | 2 | 2 | 1 | - | - | - | - | - | - | 1 |
| CO5 | 3 | 3 | 2 | 2 | 1 | - | - | - | - | - | - | 1 |
| CO6 | 3 | 3 | 2 | 2 | 1 | - | - | - | - | - | - | 1 |

SEMESTER - III

| | | | | | |
|-------------------------------|-----------------------------------|----------|----------|----------|------------|
| 20ITPL301 SDG NO. 4 | DATA STRUCTURES LABORATORY | L | T | P | C |
| | | 0 | 0 | 3 | 1.5 |

OBJECTIVES:

- To implement Linear and Non-linear Data Structures
- To understand the different operations of Search Trees
- To implement Graph Traversal algorithms
- To get familiarized to Sorting and Searching algorithm

LIST OF EXPERIMENTS:

1. Array implementation of Stack and Queue ADTs
2. Array implementation of List ADT
3. Linked list implementation of List, Stack and Queue ADTs
4. Applications of List, Stack and Queue ADTs
5. Implementation of Binary Trees and operations of Binary Trees
6. Implementation of Binary Search Trees
7. Implementation of AVL Trees
8. Implementation of Heaps using Priority Queues
9. Graph representation and Traversal algorithms

10. Applications of Graphs- Implementation of searching and sorting algorithms
11. Implementation of any two Collision Techniques in Hashing

TOTAL: 45 PERIODS**LAB REQUIREMENTS :**

Turbo C/Dev C++, Borland C

OUTCOMES:**On completion of this laboratory course, the student should be able to**

1. Write functions to implement linear and non-linear data structure operations. [K1]
2. Suggest appropriate linear / non-linear data structure operations for solving a given problem. [K2]
3. Design and analyze the time and space efficiency of data structure. [K2]
4. Apply sorting and searching techniques. [K3]
5. Apply appropriate hash functions that result in a collision free scenario for data storage and retrieval. [K3]
6. Choose and implement efficient data structures and apply them to solve problems. [K3]

CO- PO, PSO MAPPING :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | 2 | 3 | 1 | 2 | 1 | 1 | - | - | - | - | 2 | 2 |
| CO2 | 2 | 3 | 2 | 2 | 2 | 1 | - | - | - | - | 2 | 3 |
| CO3 | 3 | 3 | 2 | 2 | 1 | 1 | - | - | - | - | 2 | 2 |
| CO4 | 3 | 3 | 2 | 2 | 1 | 1 | - | - | - | - | 2 | 3 |
| CO5 | 1 | 2 | 2 | 1 | 2 | 1 | - | - | - | - | 1 | 1 |
| CO6 | 1 | 2 | 2 | 1 | 1 | - | - | - | - | - | 1 | 1 |

SEMESTER - III

| | | | | | |
|-----------------------------------|--|----------|----------|----------|----------|
| 20CCPL301 SDG NO. 4 & 9 | DIGITAL CIRCUITS LABORATORY | L | T | P | C |
| | | 0 | 0 | 3 | 1 |

OBJECTIVES:

- To understand the various basic logic gates
- To design and implement the various combinational circuits

- To design and implement combinational circuits using MSI devices.
- To design and implement sequential circuits
- To understand and code with HDL programming

LIST OF EXPERIMENTS :

1. Verify
 - (a) Demorgan's Theorem for 2 variables.
 - (b) The sum-of product and product-of-sum expressions using universal gates.
2. Design and implement
 - (a) Full Adder using basic logic gates.
 - (b) Full subtractor using basic logic gates.
3. Design and implement 4-bit Parallel Adder/ subtractor using IC 7483
4. Design and Implementation of 4-bit Magnitude Comparator using IC 7485.
5. Demonstrate Multiplexer and Demultiplexer
6. Implement Encoder and Decoder
7. Implement shift register using sequential circuit
8. Realize the Mod-N Counter using Ic7490.
9. Simulate Combinational circuits using Verilog HDL.
10. Simulate sequential circuits using Verilog HDL.

TOTAL: 45 PERIODS

LAB REQUIREMENT FOR A BATCH OF 30 STUDENTS / 2 STUDENTS PER EXPERIMENT:

S.No. EQUIPMENTS

1. Digital trainer kits – 30
2. Digital ICs required for the experiments in sufficient numbers
3. HDL simulator

OUTCOMES

On completion of this laboratory course, the student should be able to:

1. Analyze simplified combinational circuits using basic logic gates. (K4)
2. Illustrate the basics of Adder and subtractor. (K3)
3. Evaluate combinational circuits using MSI devices. (K5)
4. Design sequential circuits like registers and counters. (K6)
5. Simulate combinational and sequential circuits using HDL. (K6)
6. Simulate sequential circuits using Verilog HDL. (K6)

CO- PO, PSO MAPPING :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 3 | 2 | 3 | - | - | - | 1 | 2 | - | - | - | 3 | 3 |
| CO2 | 3 | 3 | 2 | 3 | - | - | - | 1 | 2 | - | - | - | 3 | 3 |
| CO3 | 3 | 3 | 2 | 2 | - | - | - | 1 | 2 | - | - | - | 3 | 3 |
| CO4 | 3 | 3 | 2 | 3 | - | - | - | 1 | 2 | - | - | - | 3 | 3 |
| CO5 | 3 | 3 | 2 | 3 | - | - | - | 1 | 2 | - | - | - | 3 | 3 |
| CO6 | 3 | 3 | 2 | 3 | - | - | - | 1 | 2 | - | - | - | 3 | 3 |

SEMESTER - III

| | | | | | |
|---|------------------------|----------|----------|----------|----------|
| 20CCTE301 SDG NO. 4,11 &15 | LIVE-IN-LAB - I | L | T | P | C |
| | | 0 | 0 | 2 | 1 |

OBJECTIVES:

- To provide opportunities for the students, expose to Industrial environment and real time work
- To enable hands-on experience in the latest Software domain
- To be familiarized with the requirements of an enterprise and address its major design areas
- To bring out the creativity in each student – build innovative applications that are usable, effective and efficient for intended users

COURSE METHODOLOGY:

1. This initiative is designed to inculcate ethical principles of research and to get involve in life-long learning process for the students.
2. This course engages students with little or no programming experience to create Java programs. Participants are introduced to object oriented programming concepts, terminology, and syntax, and the steps required to create basic Java programs using the Alice, Green foot, and Eclipse interactive development environments. Hand-on practices figure prominently throughout this course so students can experience first-hand, the power of computer programming.
3. To engage students in Information Technology beyond their robust academic curriculum that sparks curiosity and imagination while teaching critical knowledge and skills.

4. This practice will engage beyond curriculum using industry-relevant technologies that help students get ready for the next step in their educations or careers. It helps the learners expand knowledge, develop skills, and their innovativeness.
5. The initiative is designed to provide students with foundational knowledge and skills in areas of IT that are universally in high demand across computing jobs.
6. Our Java- and database-focused curriculum is designed to be delivered as part of an academic program of study, has educational learning objectives, is mapped and aligned to relevant standards and exams globally, and is available in multiple languages to improve learning experiences.

EVALUATION:

1. First evaluation (Immediately after first internal examination) : 20 marks
2. Second evaluation (Immediately after second internal examination): 30marks.
3. Final evaluation (Last week of the semester) : 50marks

Note: All the three evaluations are mandatory for course completion and for awarding the final grade.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. List the problems and conduct literature survey to identify the gap and come up with an application oriented research problem in the specific domain.(K1)
2. Understand the project characteristics and explore necessary tools and components needed at various stages of the project(K2)
3. Design and validate the proposed system using simulation.(K3)
4. Develop the Prototype of the proposed system by adapting Industrial safety standards and best financial management practices(K5)
5. Analyze the obtained results and prepare a technical report.(K4)
6. Evaluate the project and go for journals and patents publication.(K5)

CO- PO, PSO MAPPING:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| C01 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 3 | 3 |
| C02 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 |
| C03 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 |
| C04 | 2 | 2 | 2 | 1 | 2 | 1 | 1 | 1 | 3 | 2 | 3 | 3 | 3 | 2 |
| C05 | 2 | 2 | 2 | 1 | 2 | 1 | 1 | 1 | 3 | 2 | 3 | 3 | 3 | 2 |
| C06 | 2 | 2 | 2 | 1 | 2 | 1 | 1 | 1 | 3 | 2 | 3 | 3 | 3 | 2 |

SEMESTER - III

| | | | | | |
|--|--------------------------|----------|----------|----------|----------|
| 20CCTP301 SDG NO. 4,11 & 15 | SKILL ENHANCEMENT | L | T | P | C |
| | | 0 | 0 | 2 | 1 |

APTITUDE & COGNITIVE SKILLS – PHASE 1**COURSE OBJECTIVE:**

- To educate and enrich the students on quantitative ability, reasoning ability, and verbal ability.

UNIT I QUANTITATIVE ABILITY – I**6**

Problems on Trains, Time and Distance, Height and Distance, Time and Work

UNIT II QUANTITATIVE ABILITY – II**6**

Problems on Ages, Alligation or Mixture, Chain Rule, Simple Interest, Simple Equation, Theory Of Equation

UNIT III REASONING ABILITY – I**6**

Analytical Reasoning, Pipes and Cistern, Logical Problems, Logical Games, Logical Deduction, Data Sufficiency, Arithmetic Reasoning

UNIT IV VERBAL ABILITY – I**6**

Idioms & Phrases, Synonyms, Antonyms, Classification

UNIT V CREATIVITY ABILITY – I**6**

Venn Diagrams, Cube and Cuboids, Dice, Cubes and Dice, Figure Matrix

TOTAL : 30 PERIODS**REFERENCES:**

- 1) Quantitative Aptitude for Competitive Exams by R. S. Agarwal
- 2) Quantum CAT by Sarvesh Verma
- 3) A Modern Approach to Logical Reasoning by R. S. Agarwal
- 4) Verbal Ability and Reading Comprehension by Arun sharma

**PROBLEM SOLVING USING C PROGRAMMING, WEB DESIGNING BASICS,
VERILOG DESIGN – PHASE 2**

COURSE OBJECTIVE:

- To provide exposure to problem-solving through programming.
- To train the student to the basic concepts of the C-programming language.
- To provide exposure to problem-solving through programming.
- To train the student to the basic concepts of the C-programming and MATLAB programming language.
- To give the student hands-on experience with the concepts

UNIT I INTRODUCTION TO PRINCIPLES OF PROGRAMMING**6**

Introduction to Programming , Programing Domain : Artificial Intelligence, Systems Programming, Assembly Level Languages, Problem solving using Algorithms and Flowcharts.

UNIT II INTRODUCTION TO C PROGRAMMING**6**

Features of C and its Basic Structure, Simple C programs, Constants, Integer Constants, Real Constants, Character Constants, String Constants Floating-point Numbers, The type cast Operator, Interactive Programming.

Operators Expressions and Control statement, The goto statement, The if statement, The if-else statement, Nesting of if statements, The conditional expression, The break statement and continue statement.

UNIT III ARRAYS, STRINGS AND POINTERS**6**

Arrays, Multidimensional Arrays, Strings, Basics of Pointers, Pointer Arithmetic, Similarities between Pointers and One-dimensional Arrays Structures, Unions And Functions, Basics of Structures, Arrays of Structures, Pointers to Structures, Function Basics, Function Prototypes, and Passing Parameters, Structures and Functions Recursion.

UNIT IV INTRODUCTION TO HTML**6**

What is HTML? And its uses - HTML Documents -Basic structure of an HTML document - Creating an HTML document- Mark up Tags- Heading-Paragraphs - Line Breaks - HTML Tags- Elements of HTML-Working with Text - Working with HYPER LINK AND IMAGES.

UNIT V BASICS OF VERILOG**6**

Structure - Operators - data types - Styles of description - Data flow description - Behavioral description - Implement logic gates using Verilog data flow description.

TOTAL : 30 PERIODS**REFERENCES:**

1. Programming in ANSI C - Balagurusamy - Tata McGraw-Hill Education, 2008.
2. Programming in C (3rd Edition), by Stephen G. Kochan, Sams, 2004.
3. Programming in C - Stephen G. Kochan, III Edition, Pearson Education.
4. HTML Black Book by steven Holzner, DREAMTECH PRESS
5. Learn HTML for Beginners,author:JO FOSTER.
6. VIDEO REFERNCES in general about basic HTML available in youtubes.
7. Samir Palnitkar, "Verilog HDL", 2nd Edition, Pearson Education, 2003.
8. J Bhasker, "Verilog Hdl Primer", 3rd Edition, Bs Publications, 2015.

ONLINE RESOURCES

1. <https://nptel.ac.in/courses/108/102/108102045/>

COURSE OUTCOMES :

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

1. Analyze their quantitative ability. (K4)
2. Understand the ability of arithmetic reasoning along with creative thinking and problem solving skills. (K2)
3. Create their verbal ability through vocabulary building and grammar. (K6)
4. Evaluate the situations to analyse the computational methods in order to identify and abstract the programming task involved. (K5)
5. Analyse tasks in which the numerical techniques are applicable in order to apply them to write, edit, compile, debug, correct, recompile and run programs. (K4)
6. Design of Simple Webpage using HTML and Stimulate the VERILOG code for digital circuits (K6).

CO- PO & PSO MAPPING:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PS01 | PS02 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | - | - | - | - | 3 | 2 | - | 3 | 2 | 3 | - | 2 | - | - |
| CO2 | - | - | - | - | 3 | 2 | - | 3 | 2 | 3 | - | 2 | - | - |
| CO3 | - | - | - | - | 3 | 2 | - | - | 1 | 3 | - | 2 | - | - |
| CO4 | - | - | - | - | 3 | 2 | - | 3 | 3 | 3 | - | 2 | 2 | 2 |
| CO5 | - | - | - | - | 3 | 2 | - | - | 2 | 3 | - | 2 | 2 | 2 |
| CO6 | - | - | - | - | 3 | 2 | - | - | 2 | 3 | - | 2 | 2 | 2 |

SEMESTER - III

| | | | | | |
|--------------------------------------|------------------------------|----------|----------|----------|----------|
| 20MGMC301 SDG NO. 4 | CONSTITUTION OF INDIA | L | T | P | C |
| | | 2 | 0 | 0 | 0 |

OBJECTIVES:

At the end of the course, the student is expected to

- To know about Indian constitution
- To know about central government functionalities in India
- To know about state government functionalities in India
- To know about Constitution function
- To Know about Constitutional remedies

UNIT I INTRODUCTION**6**

Historical Background – Constituent Assembly of India – Philosophical foundations of the Indian Constitution – Preamble – Fundamental Rights – Directive Principles of State Policy – Fundamental Duties

UNIT II STRUCTURE AND FUNCTION OF CENTRAL GOVERNMENT**6**

Union Government – Structures of the Union Government and Functions – President – Vice President – Prime Minister – Cabinet – Parliament – Supreme Court of India.

UNIT III STRUCTURE AND FUNCTION OF STATE GOVERNMENT**6**

State Government – Structure and Functions – Governor – Chief Minister – Cabinet – State Legislature – Judicial System in States – High Courts and other Subordinate Courts.

UNIT IV CONSTITUTION FUNCTIONS**6**

Indian Federal System – Centre – State Relations – President's Rule – Constitutional Amendments – Constitutional Functionaries.

UNIT V CONSTITUTIONAL REMEDIES**6**

Enforcement of fundamental rights - Power of parliament to modify the rights the conferred by this part in their application to forces.

TOTAL: 30 PERIODS**TEXT BOOKS:**

1. Durga Das Basu, "Introduction to the Constitution of India", Prentice Hall of India, New Delhi.
2. R.C. Agarwal, (1997) "Indian Political System", S. Chand and Company, New Delhi.
3. M.V. Pyle (2019), "An Introduction to The Constitution of India, 5/e", Vikas Publishing, New Delhi.
4. P.M. Bakshi, (2018), "Constitution of India", Universal Law Publishing, New Delhi.

REFERENCES:

1. Sharma, Brij Kishore, "Introduction to the Constitution of India", Prentice Hall of India, New Delhi.
2. U.R.Gahai, "Indian Political System", New Academic Publishing House, Jalandhar.

OUTCOMES:**Upon completion of the course, the student should be able to**

1. Understand about Constitution & Fundamental rights of citizens. (K2)
2. Interpret the structure and hierarchy of Central and State Government. (K2)
3. Analyze the functions of Judiciary, Parliament and its constituent members. (K4)
4. Evaluate the functions and boundaries of Central and State Governments in respect of their powers, duties and Centre-State relationship. (K5)
5. Remember the Indian social structure in respect of caste, religion, language, rights to citizens particularly rights to women, children and weaker sections. (K1)
6. Analyze remedies and rights available to India Citizens. (K4)

CO – PO MAPPING:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| C01 | - | - | - | - | - | 1 | - | - | - | - | - | - |
| C02 | - | - | | - | - | 1 | - | - | - | - | - | - |
| C03 | - | - | - | - | - | 1 | - | - | - | - | - | - |
| C04 | - | - | - | - | - | 1 | - | - | - | - | - | - |
| C05 | - | - | - | - | - | 2 | - | 3 | - | - | - | - |
| C06 | - | - | - | - | - | 2 | - | 2 | - | - | - | - |

SEMESTER - IV

| | | | | | |
|-------------------------------|---|----------|----------|----------|----------|
| 20CCPC401 SDG NO. 4 | ANALOG & DIGITAL COMMUNICATION | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To acquaint knowledge with the fundamental concepts of AM and FM Modulation techniques.
- To understand the basics of Pulse Modulation and Baseband Formatting techniques.
- To compare the Error Performance of Bandpass Signaling Schemes and Data Communication concepts.
- To impart essential knowledge on Information Theory and Coding Techniques.
- To learn the significance of Multiple Access Techniques and Cellular Concepts.

UNIT I ANALOG COMMUNICATION SYSTEMS

9

Analog Modulation, Need for Modulation, Principles of Amplitude Modulation – DSBFC, DSBSC, SSB and VSB, AM Transmitters, AM Receivers – TRF, Super heterodyne Receiver.

Angle Modulation, Mathematical Analysis, Deviation Sensitivity, FM and PM Waveform, Phase Deviation and Modulation Index, Frequency Deviation and Modulation Index, Phase and Frequency Modulators and Demodulators, FM Transmitters, Pre-emphasis and Deemphasis.

UNIT II PULSE MODULATION SYSTEMS

9

Overview of Sampling and Quantization Techniques, Types of Sampling-Impulse Sampling, Natural Sampling, Flat Top Sampling, Generation and Detection of PAM, PWM & PPM.

Principles of PCM, Signal to Quantization Noise of PCM, Companding, DPCM Transmitter and Receiver, ADPCM, DM, Drawbacks of DM, ADM, Vocoders, Line Coding Techniques.

UNIT III DIGITAL MODULATION AND DATA COMMUNICATION SYSTEMS

9

Amplitude Shift Keying, Binary Frequency Shift Keying, Binary Phase Shift Keying, Quadrature Phase Shift Keying, Quadrature Amplitude Modulation, Differential Phase Shift Keying, Signal Space Representations, Probability of Error and Bit Error Rate, Error Performance.

Introduction to Data Communication and Networking, Fundamental Concepts of Data Communication.

UNIT IV INFORMATION THEORY AND CODING TECHNIQUES 9

Information Rate, Discrete Memoryless Source, Entropy, Source Coding Theorem, Discrete Memoryless Channel, Mutual Information, Channel Capacity, Channel Coding Theorem, Information Capacity Theorem.

Error Control Coding – Linear Block Codes, Cyclic Codes, Convolutional Codes and Viterbi Decoding.

UNIT V MA TECHNIQUES AND MULTIUSER RADIO COMMUNICATION 9

Multiple Access Techniques - TDMA, FDMA, CDMA, OFDM, Cellular Telephony Concepts and Frequency Reuse, Global System for Mobile Communication, GPRS, AMPS, 2G, 3G, 4G, VoLTE Architecture, Bluetooth.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Wayne Tomasi, "Electronic Communication Systems", Pearson Education, Fifth Edition, 2008. (Unit I, III, V)
2. Simon Haykin, "Communication Systems", John Wiley & Sons INC, 4th Edition, 2001 (Unit II, IV)

REFERENCES:

1. H.Taub, D L Schilling and G.Saha, "Principles of Communication", Pearson Education, 3rd Edition, 2007.
2. B.P.Lathi, "Modern Analog and Digital Communication systems", Oxford Press, 3rd Edition, 2007.
3. Rappaport TS, "Wireless Communication Principles and Practice", Pearson Education, 2nd Edition, 2007.
4. Dennis Roddy and John Coolen, "Electronic Communications", Pearson Education, 4th Edition, 2008.
5. George Kennedy, Bernard Davis, "Electronic communication systems", Tata McGraw Hill, 4th Edition, 2008.
6. Martin.S.Roden, "Analog and Digital Communication systems", Prentice Hall of India, 3rd Edition, 2002.

WEB REFERENCES:

1. <https://nptel.ac.in/courses/117/105/117105143/>
2. <https://nptel.ac.in/courses/117/101/117101051/>
3. <http://web.stanford.edu/class/ee179/lectures/notes12.pdf>

ONLINE RESOURCES:

1. <https://freevideolectures.com/course/4902/nptel-error-control-coding>
2. <https://futureskillsnasscom.edcast.com/insights/ECL-2313b997-6188-4081-9439-b8850dc15884>

OUTCOMES:**Upon completion of the course, the student should be able to:**

1. Understand the basic concepts of the analog communication systems. (K1)
2. Compute modulation index, bandwidth and power requirements for various analog modulation schemes. (K3)
3. Analyze various data and pulse transmission schemes. (K3)
4. Compare different types of shift keying techniques. (K2)
5. Evaluate the knowledge of Information theory and describe the error control codes like block code, cyclic code. (K4)
6. Analyze the digital communication system about multi user communication concepts, radio communication and wireless technology. (K3)

CO- PO, PSO MAPPING :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| C01 | 3 | 3 | 2 | - | 3 | - | - | - | - | - | 2 | 2 | 3 | 2 |
| C02 | 3 | 3 | 2 | - | 3 | - | - | - | - | - | 2 | 2 | 3 | 2 |
| C03 | 3 | 3 | 2 | - | 3 | - | - | - | - | - | 2 | 2 | 3 | 2 |
| C04 | 3 | 3 | 2 | - | 3 | - | - | - | - | - | 2 | 2 | 3 | 2 |
| C05 | 3 | 3 | 2 | - | - | - | - | - | 2 | 3 | 2 | 2 | 3 | 2 |
| C06 | 3 | 3 | 2 | - | 3 | - | - | - | - | - | 2 | 2 | 3 | 2 |

SEMESTER - IV

| | | | | | |
|-----------------------------------|------------------------------------|----------|----------|----------|----------|
| 20CSPC402 SDG NO. 4 & 9 | DATABASE MANAGEMENT SYSTEMS | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To design a database using ER diagrams, convert them to Relational Databases and to write SQL Queries
- To understand the fundamental concepts of Transaction Processing, Concurrency Control techniques and Recovery procedures
- To understand the Internal Storage structures and about the Query Processing Techniques
- To have an introductory knowledge about the Object Databases, XML Databases and NoSQL Databases

UNIT I DATABASE DESIGN

7

Purpose of Database System – Views of Data – Database System Architecture – Data Models – Entity Relationship Model – ER Diagrams – Enhanced ER Model.

UNIT II RELATIONAL DATABASES

11

Introduction to Relational Databases – Relational Model – ER-to-Relational Mapping – Keys – Relational Algebra – SQL Fundamentals – Advanced SQL features – Embedded SQL – Dynamic SQL – Functional Dependencies – Non-loss Decomposition – First – Second – Third Normal Forms – Dependency Preservation – Boyce/Codd Normal 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 – Isolation Levels – SQL Facilities for Concurrency and Recovery.

UNIT IV IMPLEMENTATION TECHNIQUES

9

RAID – File Organization – Organization of Records in Files – Indexing and Hashing – Ordered Indices – B+ Tree Index Files – B Tree Index Files – Static Hashing – Dynamic Hashing – Query Processing Overview – Algorithms for SELECT and JOIN operations – Query optimization using Heuristics – Cost Estimation.

UNIT V ADVANCED TOPICS

Distributed Databases – Architecture - Data Storage - Transaction Processing – Object Based Databases - Object Database Concepts – Object Relational Features - ODMG Object Model – ODL - OQL – XML Databases - XML Hierarchical Model – DTD - XML Schema – Xquery.

TOTAL: 45 PERIODS**TEXT BOOKS:**

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, “Database System Concepts”, Seventh Edition, Tata McGraw Hill, 2020.
2. RamezElmasri, Shamkant B. Navathe, “Fundamentals of Database Systems”, Seventh Edition, Pearson Education, 2016.

REFERENCES:

1. C.J.Date, A.Kannan, S.Swamynathan, “An Introduction to Database Systems”, Eighth Edition, Pearson Education, 2006.
2. Raghu Ramakrishnan, “Database Management Systems”, Fourth Edition, McGraw-Hill Education, 2015.
3. G.K.Gupta, “Database Management Systems”, Tata McGraw Hill, 2011.

WEB REFERENCES:

1. https://swayam.gov.in/nd1_noc19_cs46/
2. <http://www.nptelvideos.in/2012/11/database-management-system.html>
3. <https://www.classcentral.com/course/swayam-database-management-system-9914>
4. <http://learnsql.com>
5. <https://www.w3schools.com/sql/default.asp>
6. <https://www.khanacademy.org/computing/computer-programming/sql>

OUTCOMES:

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

1. Discuss the concepts of database to apply the Relational, ER model for design and SQL for implementation of the database. (K2)
2. Recognize and identify the use of normalization and functional dependencies to refine the database system. (K1)
3. Execute various SQL queries for the Transaction Processing & Locking using concept of Concurrency control. (K4)
4. Evaluate the query processing techniques for the optimization of SQL queries. (K4)

5. Implement the indexing and hashing techniques for the organisation of database records. (K3)
6. Appraise how the advanced databases differ from the traditional databases. (K5)

CO- PO, PSO MAPPING :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| C01 | 2 | 1 | 1 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 |
| C02 | 2 | 2 | 2 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 |
| C03 | 2 | 1 | 2 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 |
| C04 | 2 | 2 | 2 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 |
| C05 | 2 | 2 | 2 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 |
| C06 | 2 | 2 | 2 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 |

SEMESTER - IV

| | | | | | |
|------------------------|--------------------------------------|---|---|---|---|
| 20CCPW401 SDG NO. 4 | OPERATING SYSTEMS WITH LABORATORY | L | T | P | C |
| | | 3 | 1 | 0 | 4 |

OBJECTIVES:

- To understand the basic concepts and functions of operating systems.
- To understand Processes and Threads
- To analyze Scheduling algorithms.
- To understand the concept of Deadlocks.
- To analyze various memory management schemes.
- To understand I/O management and File systems.
- To be familiar with the basics of Linux system and Mobile OS like iOS and Android.

UNIT I OPERATING SYSTEM OVERVIEW

7

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

11

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

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

Mass Storage system – Overview of Mass Storage Structure, Disk Structure, Disk Scheduling and Management, swap space 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, Efficiency and Performance, Recovery; I/O Systems – I/O Hardware, Application I/O interface, Kernel I/O subsystem, Streams, Performance.

UNIT V LAB COMPONENT – LIST OF EXPERIMENTS

24

1. Linux Commands
2. Shell Programming
3. Process Management using System Calls: Fork, Exit, Getpid, Wait, Close, Stat
4. Interprocess Communication using Pipes, Shared Memory and Message Queues
5. CPU Scheduling Algorithms
6. Banker's Algorithm
7. Memory Management Schemes.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Silberschatz A, Galvin P and Gagne G "Operating Systems Concepts", John Wiley & Sons, USA, 2009.
2. Andrew S Tanenbaum and Herbert Bos, "Modern Operating Systems", Prentice Hall of India, New Delhi, 2015.

REFERENCES:

1. Andrew S Tanenbaum, "Modern Operating Systems Design and Implementation", Prentice Hall of India, New Delhi, 2009.
2. William Stallings, –"Operating Systems: Internals and Design Principles" Pearson, 2013.
3. Gary Nutt, "Operating Systems", Addison Wesley, USA, 2009.
4. Harvey M Deitel, "Operating System", Prentice Hall of India, New Delhi, 2008.

WEB REFERENCES:

1. https://swayam.gov.in/nd1_noc20_cs04/preview
2. <https://www.udacity.com/course/introduction-to-operating-systems--ud923>

ONLINE RESOURCES:

1. <https://freevideolectures.com/course/5031/nptel-operating-systems>
2. https://www.tutorialspoint.com/operating_system/os_overview.htm

OUTCOMES:**Upon completion of the course, the student should be able to**

1. Identify the role of Operating System and to understand the design of control unit. (K2)
2. Understand CPU Scheduling, Synchronization, Deadlock Handling and Comparing CPU Scheduling Algorithms. Solve Deadlock Detection Problems. (K2)
3. Analyze the role of paging, segmentation and virtual memory in operating systems. (K3)
4. Evaluate the knowledge of protection and security and also the Comparison of UNIX and Windows based OS. (K5)
5. Define I/O systems, Device Management Policies and Secondary Storage Structure and Evaluation of various Disk Scheduling Algorithms. (K5)
6. Create and Demonstrate the various operations of file system. (K6)

CO-PO, PSO MAPPING :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 2 | 2 | 2 | 1 | 2 | - | - | - | - | 1 | 2 | 3 | 2 |
| CO2 | 3 | 2 | 3 | 2 | 1 | 2 | - | - | - | - | 1 | 2 | 3 | 2 |
| CO3 | 3 | 2 | 3 | 2 | 1 | 2 | - | - | - | - | 1 | 2 | 3 | 2 |
| CO4 | 3 | 2 | 3 | 2 | 1 | 2 | - | - | - | - | 1 | 2 | 3 | 2 |
| CO5 | 3 | 2 | 3 | 2 | 1 | 2 | - | - | 2 | 3 | 1 | 2 | 3 | 2 |
| CO6 | 3 | 2 | 3 | 2 | 1 | 2 | - | - | - | - | 1 | 2 | 3 | 2 |

SEMESTER - IV

| | | | | | |
|--------------------------------------|--|----------|----------|----------|----------|
| 20ECPC302 SDG NO. 3,4,7,15 | ELECTROMAGNETIC FIELDS AND WAVEGUIDES | L | T | P | C |
| | | 3 | 1 | 0 | 4 |

OBJECTIVES:

- To gain conceptual and basic mathematical understanding of electric and magnetic fields in free space and in materials
- To understand the coupling between electric and magnetic fields through Faraday's law, displacement current and Maxwell's equations
- To understand wave propagation in lossless and in lossy media
- To be able to solve problems based on the above concepts
- To understand signal propagation at radio frequencies and analyse the rectangular and circular waveguides

UNIT I INTRODUCTION**9**

Electromagnetic model, Units and constants, Review of vector algebra, Rectangular, cylindrical and spherical coordinate systems, Line, surface and volume integrals, Gradient of a scalar field, Divergence of a vector field, Divergence theorem, Curl of a vector field, Stoke's theorem, Null identities, Helmholtz's theorem.

UNIT II ELECTROSTATICS**9**

Electric charge, Coulomb's law, Electric field due to Line, Surface, Volume charge densities, Electric flux, Electric flux density, Gauss's law and applications, Electric potential, Potential gradient-Conductors in static electric field, Dielectrics in static electric field, Electric flux density and dielectric constant, Boundary conditions, Capacitance, Parallel, cylindrical

and spherical capacitors, Electrostatic energy and energy density, Poisson's and Laplace's equations, Uniqueness of electrostatic solutions, Current density and Point form of Ohm's law, Electromotive force and Kirchhoff's voltage law, Equation of continuity and Kirchhoff's current law.

UNIT III MAGNETOSTATICS

9

Lorentz force equation, Law of no magnetic monopoles, Ampere's law, Biot-Savart law and applications, Magnetic field intensity, Magnetic flux density, Gauss's law, Magnetic vector potential, Lorentz force equation, Boundary conditions and idea of relative permeability, Magnetic circuits, Behaviour of magnetic materials, Boundary conditions, Inductance and inductors, Magnetic energy and Magnetic energy density, Magnetic forces and torques Applications – CRT – magnetic deflection, Magnetic brake, Linear motor, Time Varying Field: Induction, Faraday's law, Lenz's law.

UNIT IV TIME-VARYING FIELDS AND MAXWELL'S EQUATIONS

9

Faraday's law, Lenz's law, Displacement current and Maxwell-Ampere law, Maxwell's equations, Potential functions, Electromagnetic boundary conditions, Wave equations and solutions, Plane waves in lossless media, Plane waves in lossy media (low-loss dielectrics and good conductors), Group velocity, Electromagnetic power flow and Poynting vector.

UNIT V WAVEGUIDES

9

Introduction to Rectangular and Circular Waveguides, Solutions of field Equations in Rectangular Co-ordinates, TE_{mn} & TM_{mn} Modes in Rectangular Waveguides, solutions of a field equations in cylindrical coordinates, TE_{mn} & TM_{mn} Modes in Circular Waveguides, Impossibility of TEM waves in Rectangular wave guides, Waveguide Parameters — Cut-off wavelength, Guide wavelength, Free space Wavelength, Phase velocity, Group velocity, Dominant and Degenerated Modes, Power Transmission and Power losses in Rectangular and Circular Waveguides

TOTAL : 45 PERIODS

TEXT BOOKS

1. D.K. Cheng, "Field and Wave Electromagnetics", 2nd Edition, Pearson (India), 1989. (UNIT I - IV).
2. John. D. Ryder, "Network Lines and Fields", 2nd Edition, PHI Learning, 2005. (Unit V).

REFERENCES:

1. D.J. Griffiths, "Introduction to Electrodynamics", 4th Edition, Pearson (India), 2013.

- M.N.O. Sadiku and S.V. Kulkarni, "Principles of Electromagnetics", 6th Edition, Oxford (Asian Edition), 2015.
- E. C. Jordan and K.G. Balmain, "Electromagnetic Waves and Radiating Systems", Prentice Hall of India, 2006.

WEB RESOURCES :

- <https://ocw.mit.edu/resources/res-6-002-electromagnetic-field-theory-a-problem-solving-approach-spring-2008/textbook-contents/>

ONLINE RESOURCES :

- <https://freevideolectures.com/course/2340/electromagnetic-fields>
- <https://ocw.mit.edu/resources/res-6-001-electromagnetic-fields-and-energy-spring-2008/index.htm>

OUTCOMES:

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

- Apply fundamentals of Vector analysis in 3D coordinate systems. (K1)
- Review the basic concepts and laws in Electromagnetics to Compute the field quantities. (K2)
- Examine the behavior of materials in Electric and Magnetic fields. (K3)
- Derive Maxwell's equations and wave equations for static and time varying fields. (K3)
- Discuss propagation of Electromagnetic waves in lossy and lossless mediums. (K3)
- Analyze the characteristics of TE and TM waves in rectangular and cylindrical waveguides. (K3)

CO - PO, PSO MAPPING:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 2 | 2 | - | - | - | - | 1 | 1 | - | 1 | 1 | 1 | 1 |
| CO2 | 3 | 2 | 2 | - | - | - | - | 1 | 1 | - | 1 | 1 | 1 | 1 |
| CO3 | 3 | 2 | 2 | - | - | - | - | 1 | 1 | - | 1 | 1 | 1 | 1 |
| CO4 | 3 | 2 | 2 | - | - | - | - | 1 | 1 | - | 1 | 1 | 1 | 1 |
| CO5 | 3 | 2 | 2 | - | - | - | - | 1 | 1 | - | 1 | 1 | 1 | 1 |
| CO6 | 3 | 2 | 2 | - | - | - | - | 1 | 1 | - | 1 | 1 | 1 | 1 |

SEMESTER - IV

| | | | | | |
|------------------|--|----------|----------|----------|----------|
| 20BSMA401 | PROBABILITY THEORY AND STOCHASTIC PROCESSES | L | T | P | C |
| SDG NO. 4 | | 3 | 1 | 0 | 4 |

OBJECTIVES:

- To provide the mathematical background of random variables, standard distributions and random processes for application to signal processing and Communication theory

UNIT I RANDOM VARIABLES AND STANDARD DISTRIBUTIONS 12

Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal Distributions - Functions of Random variables.

UNIT II TWO - DIMENSIONAL RANDOM VARIABLES 12

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and Linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT III INTRODUCTION TO STOCHASTIC PROCESS 12

Classification – Auto correlation functions – Cross correlation functions - Stationary process –Ergodic process-Power Spectral Density.

UNIT IV MODELS OF RANDOM PROCESSES 12

The Bernoulli process - The Gaussian process - Poisson process - Markov process - Markov chain.

UNIT V LINEAR SYSTEMS WITH RANDOM INPUTS 12

Linear time invariant system – System transfer function – Linear systems with random inputs – Auto correlation and Cross correlation functions of input and output.

TOTAL: 60 PERIODS

TEXTBOOKS:

1. Ibe O.C., "Fundamentals of Applied Probability and Random Processes", Elsevier, 1st Indian Reprint, 2007. Unit-I Chapter-2, Chapter-3 (Sections 3.1-3.5), Chapter-4 (Sections 4.1-4.8,4.10 & 4.11), Chapter 6 (Section 6.2) Unit-II Chapter 5 (Sections 5.1-5.7), Chapter 6 (6.8 & 6.10) Unit-III Chapter-8 (8.1-8.7),10.5 Unit-IV Chapter 10 (Section 10.2,10.4, 10.5(10.5.1-10.5.6),10.6,10.7) Unit-V Chapter 9 (Sections 9.1-9.3)

REFERENCES:

1. Peebles P.Z., "Probability, Random Variables and Random Signal Principles", Tata Mc Graw Hill, 4th Edition, New Delhi, 2002.
2. Veerarajan T., "Probability and Statistics, Random Processes and Queueing theory", Tata Mc-Graw Hill Education Pvt. Ltd., New Delhi.
3. Athanasios Papoulis and S. Unnikrishna Pillai, "Probability, Random Variables and Stochastic Processes" PHI, 4th Edition, 2002.
4. Davenport, Probability and Random Processes for Scientist and Engineers, McGraw-Hill.
5. H. Stark & J.W. Woods: Probability, Random Processes and Estimations Theory for Engineers, (2/e), Prentice Hall.
6. E. Wong: Introduction to Random Processes, Springer Verlag.
7. W.A. Gardner: Introduction to Random Processes, (2/e), McGraw Hill.

WEB REFERENCES:

1. https://swayam.gov.in/nd1_noc19_ma30/preview
2. <https://nptel.ac.in/courses/111102111/>
3. <https://nptel.ac.in/courses/111/104/111104032/>
4. <http://www.ifp.illinois.edu/~hajek/Papers/probabilityJan13.pdf>
5. <https://www.ee.iitb.ac.in/~bsraj/courses/ee325/>

ONLINE RESOURCES:

1. <https://freevidelectures.com/course/2324/probability-and-random-processes>.
2. <http://www.nptelvideos.com/course.php?id=572>.

OUTCOMES:**Upon completion of the course, the student should be able to**

1. Compute the probability and statistical averages of one dimensional, two-dimensional discrete, continuous random variables and their standard distributions. (K3)
2. Calculate the Autocorrelation, Cross correlation, power spectral density and cross power spectral density of a random processes and linear system. (K3)
3. Calculate the limiting state probabilities of Markov chains and use Central limit theorem to find the approximate probabilities of the sum of large numbers of independent and identically distributed random variables and use transformation of random variables to find the joint and marginal probability density functions. (K3)

4. Explain Stationary, Ergodic, Markov, Poisson, Bernoulli and Gaussian processes. (K2)
5. Explain the properties of statistical averages of a random variable, random processes, Poisson process and linear system. (K2)
6. Determine the spectral properties of output when the input function is given to a linear system. (K3)

CO - PO, PSO MAPPING:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | 3 | 3 | 2 | 1 | - | - | - | - | | - | - | 1 |
| CO2 | 3 | 3 | 2 | 1 | - | - | - | - | - | - | - | 1 |
| CO3 | 3 | 3 | 2 | 1 | - | - | - | - | - | - | - | 1 |
| CO4 | 3 | 3 | 2 | 1 | - | - | - | - | - | - | - | 1 |
| CO5 | 3 | 3 | 2 | 1 | - | - | - | - | - | - | - | 1 |
| CO6 | 3 | 3 | 2 | 1 | - | - | - | - | - | - | - | 1 |

SEMESTER - IV

| | | | | | |
|-----------------------------------|---|----------|----------|----------|------------|
| 20CCPL401 SDG NO. 4 & 9 | COMMUNICATION SYSTEMS LABORATORY | L | T | P | C |
| | | 0 | 0 | 3 | 1.5 |

OBJECTIVES:

- To implement AM and FM Modulation and Demodulation
- To visualize the effect of Sampling and TD
- Observe and plot the different Baseband Formatting Techniques like PCM,DM
- Generate Digital Modulation signals for ASK, FSK, PSK and perform their detection
- Simulate and plot the different Digitally Modulated Signal and Error Coding Schemes.

LIST OF EXPERIMENTS :

1. Signal Sampling and Reconstruction
2. AM Modulation and Demodulation
3. FM Modulation and Demodulation
4. Time Division Multiplexing
5. Pulse Code Modulation and Demodulation
6. Delta Modulation and Demodulation

7. Generation and Detection of ASK, FSK & PSK
8. Line Coding Techniques
9. Simulation of AM and FM using MATLAB
10. Simulation of ASK, FSK, PSK using MATLAB
11. Simulation of QPSK and QAM using MATLAB
12. Error Detection and Correction techniques.

TOTAL: 45 PERIODS

LAB REQUIREMENTS

1. Communication Trainer kits for Sampling, TDM, AM, FM, Pulse Modulation, PCM, DM, ASK, FSK, PSK
2. CRO (30MHz) – 15 Nos
3. MATLAB or equivalent software package for simulation
4. PC- 10 Nos
5. Communication Trainer kits for Sampling, TDM, AM, FM, Pulse Modulation, PCM, DM, ASK, FSK, PSK
6. CRO (30MHz) – 15 Nos

OUTCOMES:

On completion of this laboratory course, the student should be able to

1. Study and design Sampling and Reconstruction. (K2)
2. Design AM and FM Modulators. (K4)
3. Analyze the performance characteristics of TDM (K4)
4. Demonstrate various Pulse Modulation and Digital Modulation Techniques. (K5)
5. Apply various Channel Coding Schemes to improve the Noise Performance of the Communication System. (K3)
6. Simulate and validate the various Functional Modules of Digital Communication System. (K5)

CO-PO,PSO MAPPING :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 3 | 1 | 2 | 1 | - | - | - | 1 | - | 2 | 3 | 3 | 2 |
| CO2 | 3 | 3 | 1 | 2 | 1 | - | - | - | 1 | - | 2 | 3 | 3 | 2 |
| CO3 | 3 | 3 | 1 | 3 | 1 | - | - | - | 1 | - | 2 | 3 | 3 | 2 |
| CO4 | 3 | 3 | 1 | 2 | 1 | - | - | - | 1 | - | 2 | 3 | 3 | 2 |
| CO5 | 3 | 3 | 1 | 1 | 1 | - | - | - | 1 | - | 2 | 3 | 3 | 2 |
| CO6 | 3 | 3 | 1 | 2 | 1 | - | - | - | 1 | - | 2 | 3 | 3 | 2 |

SEMESTER - IV

| | | | | | |
|--------------------------|-----------------------------------|----------|----------|----------|------------|
| 20CSPL402 | DATABASE MANAGEMENT SYSTEM | L | T | P | C |
| SDG NO. 4 & 9 | LABORATORY | 0 | 0 | 3 | 1.5 |

OBJECTIVES:

- To learn the use of Data Definition, Data Manipulation Commands, Nested and Join queries
- To understand Functions, Procedures and Procedural extensions of databases
- To be familiar with the use of a Front End tool
- To understand design and implementation of typical Database applications
-

LIST OF EXPERIMENTS :

1. Data Definition Commands, Data Manipulation Commands for inserting, deleting, updating and retrieving Tables and Transaction Control statements.
2. Database Querying – Simple queries, Nested queries, Sub queries and Joins.
3. Implementation of Views, Sequences and Synonyms.
4. Database Programming: Implicit and Explicit Cursors.
5. Procedures and Functions.
6. Triggers.
7. Exception Handling.
8. Database Design using ER Modeling, Normalization and Implementation for any application.
9. Database Connectivity with Front End Tools.
10. Case Study using Real Life Database applications.

TOTAL: 45 PERIODS

LAB REQUIREMENTS

SOFTWARE

Front end: VB/VC ++/JAVA or Equivalent

Back end: Oracle / SQL / MySQL/ Postgres / DB2 or Equivalent

OUTCOMES :

On completion of this laboratory course, the student should be able to

1. Use typical data definitions and manipulation commands. (K1)
2. Design applications to test Nested and Join Queries. (K3)
3. Implement simple applications that use Views. (K3)

4. Critically analyze the use of Tables, Views, Functions and Procedures. (K4)
5. Make use of ER modeling and normalization to design and implement database. (K3)
6. Implement real life applications that require a Front-end Tool as a Team. (K3)

CO- PO, PSO MAPPING :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| C01 | 2 | 1 | 1 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 |
| C02 | 2 | 2 | 2 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 |
| C03 | 2 | 2 | 2 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 |
| C04 | 2 | 2 | 2 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 |
| C05 | 2 | 2 | 2 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 |
| C06 | 2 | 2 | 2 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 |

SEMESTER - IV

| | | | | | |
|--|-------------------------|----------|----------|----------|----------|
| 20CCTE401 SDG NO. 4,11&15 | LIVE-IN-LAB - II | L | T | P | C |
| | | 0 | 0 | 2 | 1 |

OBJECTIVES:

- To provide opportunities for the students, expose to Industrial environment and real time work
- To enable hands-on experience in the electronics hardware/Software domain
- To enable development of skill set for designing and realizing prototype electronic systems/simulation model

COURSE METHODOLOGY

- This initiative is designed to inculcate ethical principles of research and to get involve in life-long learning process for the students.
- The project work must involve engineering design with realistic constraints. It must also include appropriate elements of the following: Engineering standards, design analysis, modeling, simulation, experimentation, prototyping, fabrication, correlation of data, and software development.

- Project can be individual work or a group project, with maximum of 3 students. In case of group project, the individual project report of each student should specify the individual's contribution to the group project.
- On completion of the project, the student shall submit a detailed project report. The project should be reviewed and the report shall be evaluated and the students shall appear for a viva-voce oral examination on the project approved by the Coordinator and the project guide.

EVALUATION

- First evaluation (Immediately after first internal examination) : 20 marks
- Second evaluation (Immediately after second internal examination): 30marks
- Final evaluation (Last week of the semester) : 50marks

Note: All the three evaluations are mandatory for course completion and for awarding the final grade.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Conduct literature survey to identify the gap and an application oriented research problem in the specific domain(K4)
2. Design and validate the proposed system using simulation(K6)
3. Prototype the proposed system(K5)
4. Analyze the obtained results and prepare a technical report(K4)
5. Publish the work in journals and apply for the patents.(K3)
6. Prepare for industrial environment and real time work(K3)

CO- PO & PSO MAPPING:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO3 | 2 | 2 | 2 | 1 | 2 | 1 | 1 | 1 | 3 | 2 | 3 | 3 | 3 | 2 |
| CO4 | 2 | 2 | 2 | 1 | 2 | 1 | 1 | 1 | 3 | 2 | 3 | 3 | 3 | 2 |
| CO5 | 2 | 2 | 2 | 1 | 2 | 1 | 1 | 1 | 3 | 2 | 3 | 3 | 3 | 2 |
| CO6 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 |

SEMESTER - IV

| | | | | | |
|-------------------------------|--------------------------|----------|----------|----------|----------|
| 20CCTP401 SDG NO. 4 | SKILL ENHANCEMENT | L | T | P | C |
| | | 0 | 0 | 2 | 1 |

PROBLEM SOLVING SKILLS – PHASE 1

COURSE OBJECTIVE:

- Improve their quantitative ability.
- Improve their reasoning ability.
- Enhance their verbal ability through vocabulary building and grammar
- Equip with creative thinking and problem solving skills

UNIT I QUANTITATIVE ABILITY – III **6**
Compound Interest - Profit and Loss - Partnership - Percentage - Set Theory

UNIT II QUANTITATIVE ABILITY – IV **6**
True Discount - Ratio and Proportion - Simplification - Problems on H.C.F and L.C.M.

UNIT III REASONING ABILITY – II **6**
Course of Action - Cause and Effect - Statement and Conclusion - Statement and Argument - Data Sufficiency (DS) - Statement and Assumption - Making Assumptions.

UNIT IV VERBAL ABILITY – II **6**
Change of Voice - Change of Speech - Letter and Symbol Series - Essential Part - Verbal Reasoning - Analyzing Arguments.

UNIT V CREATIVITY ABILITY – II **6**
Seating Arrangement - Direction Sense Test - Character Puzzles - Missing Letters Puzzles - Mirror & Water Images.

TOTAL : 30 PERIODS

REFERENCES:

- 1) R. S. Agarwal, "Quantitative Aptitude for Competitive Exams"
- 2) Sarvesh Verma, "Quantum CAT"
- 3) R. S. Agarwal, "A Modern Approach to Logical Reasoning"
- 4) Arun sharma, "Verbal Ability and Reading Comprehension"

ADVANCED C PROGRAMMING AND MATLAB AND SIMULINK PROGRAMMING - PHASE 2

COURSE OBJECTIVE:

- To improve C programming skills with understanding of code organization and functional hierarchical decomposition with using complex data types.
- To understand procedural programming methods using MATLAB & SIMULINK.

UNIT I INTRODUCTION TO RECURSION AND GROWTH FUNCTIONS 6

Introduction to Recursion - Recurrence Relation - Deriving time complexity and space complexity using recurrence relation Polynomial Equations - Compare growth functions - Nth Fibonacci Number - Exponent Function - Taylor Series - Tower of Hanoi.

UNIT II STORAGE CLASSES, THE PREPROCESSOR AND DYNAMIC MEMORY ALLOCATION 6

Storage Classes and Visibility - Automatic or local variables - Global variables - Macro Definition and Substitution - Conditional Compilation - Dynamic Memory Allocation - Allocating Memory with malloc and calloc Allocating Memory with calloc - Freeing Memory - The Concept of linked list - Inserting a node by using Recursive Programs - Deleting the Specified Node in a Singly Linked List.

UNIT III FILE MANAGEMENT AND BIT MANIPULATION 6

Defining and Opening a file - Closing Files - Input/output Operations on Files - Predefined Streams - Error Handling during I/O Operations - Random Access to Files - Command Line Arguments - The hexadecimal number system - C bitwise operators - How to generate all the possible subsets of a set - Tricks with Bits - Applications of bit operations.

UNIT IV INTRODUCTION TO MATLAB 6

Introduction to MATLAB-Commands-MATLAB Desktop and Editor-Basic Operations-Vectors and Matrices-Array Calculation-Calling Function-Obtaining Help-Plotting Data-Applications- Basic Programming.

UNIT V SIMULINK AND MATLAB OPTIMIZATION TOOLBOX 6

Introduction SIMULINK models - blocks - Systems and sub-systems - Simulating Dynamic System - Solving a model - Solvers - MATLAB SIMULINK for signal processing - Solving linear and quadratic optimization problems.

REFERENCES:

1. R. G. Dromey, "How to Solve It By Computer", Pearson, 1982
2. A.R. Bradley, "Programming for Engineers", Springer, 2011
3. Kernighan and Ritchie, "The C Programming Language", (2nd ed.) Prentice Hall, 1988
4. Amos Gilat, "Matlab, An Introduction With Applications", Wiley Publication, 4th edition
5. Brian R. Hunt, Jonathan Rosenberg, and Ronald L Lipsman, "A Guide to MATLAB", Cambridge University press.
6. Basics of MATLAB programming by R. Balaji
7. MATLAB Guide, Third Edition Third Edition by Desmond J. Higham (Author), Nicholas J. Higham (Author).
8. MATLAB For Beginners: A Gentle Approach by Peter I. Kattan (Author)

REFERENCES

1. Agam Kumar Tyagi, "Matlab and Simulink for Engineering" Oxford Higher Education
2. Rudra Pratap "Getting Started with MATLAB" Oxford Higher Education
3. Stephen J Chapman, "MATLAB Programming for Engineers", 6E, CENGAGE

ONLINE RESOURCES

1. <https://matlabacademy.mathworks.com/>
2. <https://www.tutorialspoint.com/matlab/index.htm>
3. <https://medium.com/quick-code/top-tutorials-to-learn-matlab-for-beginners-d19549ecb7b7>
4. <https://nptel.ac.in/courses/103/106/103106118/>

WEB RESOURCES

1. <https://www.mathworks.com/academia/books.html>
2. <https://in.mathworks.com/support/learn-with-matlab-tutorials.html>

COURSE OUTCOMES:

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

1. Analyze their quantitative ability. (K4)
2. Understand the ability of arithmetic reasoning along with creative thinking and problem solving skills. (K2)
3. Create their verbal ability through vocabulary building and grammar. (K6)

4. Evaluate code organization and functional hierarchical decomposition with complex data types. (K5)
5. Understand to improve C programming skills to apply advance structured and procedural programming. (K2)
6. Apply the Matlab Simulink and optimization toolbox for signal processing applications. (K3)

CO- PO & PSO MAPPING:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| C01 | - | - | - | - | 3 | 2 | - | 3 | 2 | 3 | - | 2 | - | - |
| C02 | - | - | - | - | 3 | 2 | - | 3 | 2 | 3 | - | 2 | - | - |
| C03 | - | - | - | - | 3 | 2 | - | - | 1 | 3 | - | 2 | - | - |
| C04 | - | - | - | - | 3 | 2 | - | 3 | 3 | 3 | - | 2 | 2 | 2 |
| C05 | - | - | - | - | 3 | 2 | - | - | 2 | 3 | - | 2 | 2 | 2 |
| C06 | - | - | - | - | 3 | 2 | - | - | 2 | 3 | - | 2 | 2 | 2 |

SEMESTER - V

| | | | | | |
|---------------------------------|------------------------------------|----------|----------|----------|----------|
| 20CSPC301 SDG NO. 4,9 | OBJECT ORIENTED PROGRAMMING | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To understand Object Oriented Programming concepts and principles of Packages, Inheritance and Interfaces
- To define Exceptions and use I/O streams
- To develop a Java application with threads and generic classes
- To design and build simple Graphical User Interfaces

UNIT I INTRODUCTION TO OOP AND JAVA FUNDAMENTALS 10

Object Oriented Programming – Abstraction – Objects and Classes – Encapsulation– Inheritance – Polymorphism– OOP in Java – Characteristics of Java – The Java Environment – Java Source File – Compilation - Fundamental Programming Structures in Java – Defining Classes in Java – Constructors - Methods - Access Specifiers – Static Members - Comments - Data Types Variables - Operators- Control Flow- Arrays- Packages – Javadoc Comments.

UNIT II INHERITANCE AND INTERFACES 9

Inheritance – Super Classes– Sub Classes –Protected Members – Constructors in Sub Classes– The Object Class – Abstract Classes and Methods – Final Methods and Classes – Interfaces – Defining an Interface - Implementing Interface - Differences between Classes and Interfaces and Extending Interfaces – Object Cloning -Inner Classes -Array Lists -Strings.

UNIT III EXCEPTION HANDLING AND I/O 9

Exceptions – Exception Hierarchy – Throwing and Catching Exceptions – Built in Exceptions-Creating own Exceptions - Stack Trace Elements - Input / Output Basics – Streams – Byte Streams and Character Streams – Reading and Writing Console – Reading and Writing Files

UNIT IV MULTI-THREADING AND GENERIC PROGRAMMING 8

Differences between Multi-Threading and Multitasking - Thread Life Cycle - Creating Threads - Synchronizing Threads - Inter-Thread Communication - Daemon Threads - Thread Groups - Java Concurrency Packages - Generic Programming – Generic Classes – Generic Methods – Bounded Types – Restrictions and Limitations.

UNIT V LAMBDA STREAMS AND REACTIVE PROGRAMMING 9

Lambda Expressions – Library Enhancements to Support Lambdas – No Parameter-Single Parameter - Multiple Parameters – With or Without Return Keyword-Comparator- Filter Collection Data-Streams-Generating StreamsJava Stream Interface Methods – For each-Map-Filter-Limit-Sorted - Parallel Processing - Reactive Programming– ReactiveX– ReactiveX Classes– Creating Operator– Reactive Subjects.

TOTAL: 45 PERIODS**TEXT BOOKS:**

1. Herbert Schildt, “Java - The Complete Reference”, 8 Edition, McGrawHill Education, 2011. th
2. E.Balagursamy- “Programming with Java”, 6 Edition, McGrawHill Education, 2019.

REFERENCES:

1. Paul Deitel, Harvey Deitel, “Java SE 8 for Programmers”, 3 Edition, Pearson, 2015.
2. Steven Holzner, “Java 2 Blackbook”, Dream Tech Press, 2011.
3. Timothy Budd, “Understanding Object-Oriented Programming with Java”, Updated Edition, Pearson Education, 2000.

WEB REFERENCES:

1. https://www.w3schools.com/java/java_oop.asp
2. <https://www.edureka.co/blog/object-oriented-programming/>
3. https://www.ntu.edu.sg/home/ehchua/programming/java/J3a_OOPBasics.html

ONLINE RESOURCES:

1. https://www.ntu.edu.sg/home/ehchua/programming/java/J3a_OOPBasics.html
2. <https://introcs.cs.princeton.edu/java/lectures/>

OUTCOMES:**Upon completion of the course, the student should be able to:**

1. Comprehend Object Oriented Programming Concepts in Java. (K2)
2. Illustrate the purpose of packages, Java documents and Analyze the various types of Inheritance. (K4)
3. Apply the Object Oriented Programming Concepts to develop the reusable Applications. (K3)
4. Illustrate the java applications using Java Exceptions and I/O Streams. (K4)

5. Understand the concept of Multithreading and Generic Classes in Java. (K2)
6. Design and implement Lambda expressions, streams and reactive programming. (K6)

CO - PO, PSO MAPPING:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| C01 | 2 | 1 | 2 | 2 | - | 2 | - | - | - | - | - | 2 | 3 | 2 |
| C02 | 3 | 1 | 3 | 2 | - | 2 | - | - | 2 | - | - | 2 | 3 | 2 |
| C03 | 3 | 1 | 3 | 2 | - | 2 | - | - | - | - | - | 2 | 3 | 3 |
| C04 | 3 | 1 | 3 | 2 | - | 2 | - | - | - | - | - | 2 | 3 | 2 |
| C05 | 3 | 1 | 3 | 2 | 3 | 2 | - | - | - | - | - | 2 | 3 | 2 |
| C06 | 3 | 1 | 3 | 2 | 3 | 2 | - | - | 1 | - | - | 2 | 3 | 2 |

SEMESTER - V

| | | | | | | | | |
|----------------------------------|--|--|--|--|----------|----------|----------|----------|
| 20ECPC402 SDG NO. 4,11 | MICROCONTROLLERS AND EMBEDDED SYSTEMS | | | | L | T | P | C |
| | | | | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To understand the Architecture of 8086 microprocessor.
- To learn the design aspects of I/O and Memory Interfacing circuits.
- To interface microprocessors with supporting chips.
- To study the Architecture of 8051 microcontroller and ARM processor.
- To design a microcontroller based system.

UNIT I 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 MICROCONTROLLER**9**

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

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 INTRODUCTION TO EMBEDDED SYSTEM DESIGN AND REAL TIME SYSTEMS**9**

Embedded system design process –Design example: Model train controller- Design methodologies- Design flows - Requirement Analysis – Specifications- System analysis and architecture design – Structure of a Real Time System -- Estimating program run times – Task assignment and scheduling.

UNIT V ARM PROCESSOR AND PERIPHERALS**9**

ARM Architecture Versions – ARM Architecture – Instruction Set – Stacks and Subroutines – Features of the LPC 214X Family – Peripherals – The Timer Unit – Pulse Width Modulation Unit – UART – Block Diagram of ARM9 and ARM Cortex M3MCU.

TOTAL: 45 PERIODS**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 GillispieMazidi, RolinMcKinlay, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", 2nd Edition, Pearson education, 2011. (UNIT II).
3. Marilyn Wolf, "Computers as Components - Principles of Embedded Computing System Design", 3rd Edition, Morgan Kaufmann Publisher (An imprint from Elsevier), 2012. (UNIT IV, V).
4. Jane W.S.Liu, "Real Time Systems", Pearson Education, Third Indian Reprint, 2003.(UNIT IV).

REFERENCES:

1. DouglasV.Hall, "Microprocessors and Interfacing, Programming andHardware",TMH, 2012.
2. A.K.Ray,K.M.Bhurchandi, "Advanced Microprocessors and Peripherals", 3rd Edition, Tata McGraw Hill, 2012.
3. Lyla B.Das, "Embedded Systems: An Integrated Approach", Pearson Education, 2013.
4. C.M.Krishna, Kang G.Shin, "Real-Time Systems", International Editions, McGraw Hill, 2017.

WEB REFERENCES:

1. https://swayam.gov.in/nd1_noc20_ee42/preview
2. <https://nptel.ac.in/courses/108105102/>

ONLINE RESOURCES:

1. <https://freevideolectures.com/course/3018/microprocessors-and-microcontrollers>
2. <http://www.satishkashyap.com/2012/02/video-lectures-on-microprocessors-and.html>

OUTCOMES:**Upon completion of the course, the student should be able to**

1. Explain the architecture of 8086, instruction set, concepts of modular programming, interrupt service routine and write basic Assembly Language Programs in 8086. Explain the architecture of 8086, instruction set, concepts of modular programming, interrupt service routine and write basic Assembly Language Programs in 8086. (K2)
2. Explain the internal organization of 8051, Port structures instruction set and write Assembly Language Programs in 8051. (K2)
3. Describe the architecture of peripheral ICs (8255, 8253, 8251, 8259, 8257, 8279, 8080, DAC and ADC0080). (K2)
4. Apply the interfacing concepts to develop programs for interfacing LED LCD, ADC/DAC, keyboard, traffic light controller and alarm controller with 8086 and 8051. (K3)
5. Describe the design process and scheduling concepts of real time embedded systems. (K2)
6. Illustrate the features, peripheral units and instruction set of ARM9, LPC214X, ARM Cortex M3 MCU processors. (K2)

CO - PO, PSO MAPPING :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 1 | 3 | 2 | 1 | 3 | 3 | 2 | - | - | - | 2 | 2 | 3 |
| CO2 | 3 | 1 | 3 | 1 | 2 | 3 | 2 | 1 | - | - | - | 2 | 2 | 3 |
| CO3 | 2 | 1 | 3 | 2 | 1 | 2 | 3 | 2 | - | - | - | 2 | 2 | 2 |
| CO4 | 2 | 1 | 2 | 3 | 2 | 2 | 3 | 2 | 2 | - | - | 2 | 2 | 3 |
| CO5 | 3 | 1 | 3 | 1 | 2 | 3 | 3 | 2 | - | - | - | 3 | 2 | 3 |
| CO6 | 3 | 1 | 2 | 2 | 1 | 3 | 3 | 2 | - | - | - | 2 | 2 | 2 |

SEMESTER - V

| | | | | | |
|-------------------------------|-----------------------------------|----------|----------|----------|----------|
| 20CSPW401 SDG NO. 4 | COMPUTER NETWORKS WITH LAB | L | T | P | C |
| | | 3 | 0 | 2 | 4 |

OBJECTIVES:

- To understand the protocol layering and physical level communication
- To understand the various components required to build different networks and analyze the performance of a network
- To learn the functions of network layer and the various routing protocols
- To familiarize the functions and protocols of the Transport layer

UNIT I INTRODUCTION AND PHYSICAL LAYER 9

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

UNIT II DATA LINK LAYER & MEDIA ACCESS 9

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

UNIT III NETWORK LAYER 9

Network Layer Services – Packet switching – 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.

UNIT V APPLICATION LAYER 9

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

LIST OF EXPERIMENTS: 15

1. Simple client server program.
2. Socket program for echo/ping commands.
3. Implementing Link state routing algorithm.

4. Implementing distance vector routing algorithm.
5. Study of Network Simulator (NS2 or NS3) and Simulation of Congestion Control Algorithms using NS.
6. Study of TCP/UDP performance using Simulation tool.
7. Simulation of error correction code (like CRC).
8. Traffic Analysis using Wireshark.

TOTAL: 60 PERIODS

LAB REQUIREMENTS:

1. C/C++/JAVA/Equivalent compiler
2. Network Simulator like NS2/OPNET/Wireshark

TEXT BOOKS:

1. Behrouz A. Forouzan, "Data communications and networking with TCP/IP protocol suite", Sixth Edition, McGraw Hill, cop. 2022.
2. Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", Fifth Edition, Morgan Kaufmann Publishers Inc., 2012.

REFERENCES:

1. William Stallings, "Data and Computer Communications", Tenth Edition, Pearson Education, 2014.
2. Nader F. Mir, "Computer and Communication Networks", Second Edition, Prentice Hall, 2014.
3. Ying-Dar Lin, Ren-Hung Hwang and Fred Baker, "Computer Networks: An Open Source Approach", McGraw Hill Publisher, 2011.
4. James F. Kurose, Keith W. Ross, Computer Networking, A Top-Down Approach Featuring the Internet, Sixth Edition, Pearson Education, 2013.
5. Andrew S. Tanenbaum, David J. Wetherall, "Computer Networks ", 5th edition, Pearson Education, 2011

WEB REFERENCES:

1. https://swayam.gov.in/nd2_cec19_cs07/preview
2. <https://nptel.ac.in/courses/106105081/>
3. <https://www.isi.edu/nsnam/ns/>

ONLINE RESOURCES:

1. <https://ptgmedia.pearsoncmg.com/images/9780789749048/samplepages/0789749041.pdf>
2. <https://www.cse.iitb.ac.in/~sri/cs348/cs378-lab00-overview.pdf>
3. <https://freevideolectures.com/course/2276/computer-networks>

4. <https://www.youtube.com/watch?v=g8iY36onLeM&list=PLWPirh4EWFpHJrW1D9UB24wsbM3zx7QMx>

OUTCOMES:

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

1. Understand the basic layers and its functions in computer networks. (K2)
2. Demonstrate the performance of a network. (K2)
3. Explain the basics of how data flows from one node to another. (K2)
4. Understand IEEE standards, analyze and design routing algorithms. (K2)
5. Describe the working of various transport and application layer protocols. (K2)
6. Apply the protocols for various functions in the network. (K3)

CO-PO, PSO MAPPING :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| C01 | 3 | 3 | 3 | 1 | 3 | 2 | 2 | - | 2 | 1 | - | 1 | 3 | 2 |
| C02 | 3 | 3 | 2 | - | - | - | 1 | - | - | - | - | - | 2 | 1 |
| C03 | 3 | 3 | 3 | - | 1 | - | 1 | - | - | 1 | - | 1 | 3 | 1 |
| C04 | 3 | 3 | 3 | - | - | - | 1 | - | - | 1 | - | - | 2 | 2 |
| C05 | 3 | 3 | 3 | - | 1 | - | 2 | - | - | 1 | - | 1 | 3 | 2 |
| C06 | 3 | 3 | 3 | - | 1 | - | 1 | - | - | 1 | - | - | 3 | 2 |

SEMESTER - V

| | | | | | |
|---------------------------|---|---|---|---|-----|
| 20ECPL401 SDG NO. 4,11 | MICROCONTROLLERS AND EMBEDDED SYSTEMS LABORATORY | L | T | P | C |
| | | 0 | 0 | 3 | 1.5 |

OBJECTIVES:

- To Introduce ALP concepts, features and Coding methods
- Write ALP for arithmetic and logical operations in 8086 and 8051
- Interface different I/Os with Microprocessors
- Be familiar with MASM
- Write programs for ARM

LIST OF EXPERIMENTS:**8086 Programs using kits and MASM**

1. Basic arithmetic and Logical operations.
2. Move a data block without overlap.
3. Code conversion, decimal arithmetic and Matrix operations.
4. Floating point operations, string manipulations, sorting and searching.

8051 Experiments using kits and MASM

1. Basic arithmetic and Logical operations.
2. Square and Cube program, Find 2's complement of a number.
3. Unpacked BCD to ASCII.

Peripherals and Interfacing Experiments

1. Traffic light controller.
2. Stepper motor control.
3. Digital clock.

ARM programs

1. Interfacing ADC and DAC.
2. Interfacing LED and PWM.
3. Interfacing LCD.

TOTAL: 45 PERIODS**OUTCOMES****At the end of the course, the student should be able to**

1. Write ALP for fixed and Floating Point and Arithmetic operations.(K3)
2. Execute Programs in 8051 (K5)
3. Interface various peripherals in 8086/8051.(K3)
4. Execute Programs in ARM.(K5)
5. Interface memory, A/D and D/A convertors with ARM system(K3)
6. Formulate a mini project.(K6)

CO - PO, PSO MAPPING:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 1 | 2 | 3 | 2 | 2 | - | - | - | 2 | 2 | 1 | 2 | 2 |
| CO2 | 3 | 1 | 2 | 3 | 1 | 2 | - | - | - | 2 | 2 | 3 | 2 | 2 |
| CO3 | 3 | 2 | 2 | 2 | 1 | 2 | - | - | - | 2 | 2 | 2 | 3 | 2 |
| CO4 | 3 | 2 | 2 | 3 | 3 | 2 | - | - | - | 2 | 2 | 1 | 3 | 2 |
| CO5 | 2 | 2 | 2 | 2 | 5 | 2 | - | - | - | 3 | 1 | 2 | 3 | 3 |
| CO6 | 2 | 2 | 2 | 3 | 1 | 2 | - | - | - | 2 | 3 | 2 | 3 | 3 |

SEMESTER - V

| | | | | | |
|--|---|----------|----------|----------|------------|
| 20CSPL301 SDG NO. 4,9 | OBJECT ORIENTED PROGRAMMING LABORATORY | L | T | P | C |
| | | 0 | 0 | 3 | 1.5 |

OBJECTIVES:

- To understand Object Oriented Programming concepts and basic characteristics of Java
- To know the principles of Packages, Inheritance and Interfaces
- To develop a Java application with Threads and Generic classes
- To make the students understand life cycle of the Applets and its functionality

LIST OF EXPERIMENTS :

1. Basic JAVA Programs
 - a. Write a program to find the sum of individual digits of a positive integer.
 - b. Write a program to generate the first n terms of the sequence.
 - c. Write a program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.
 - d. Write a program to find both the largest and smallest number in a list of integers.
 - e. Write a program to find factorial of list of number reading input as command.
2. Write a program to calculate bonus for different departments using method overriding.
3. Write a program to sort list of elements in ascending and descending order and show the exception handling.
4. Write a program to implement the concept of importing classes from user defined package and creating packages.

5. Write programs that illustrate how the following forms of inheritance are supported:
 - a) Single inheritance
 - b) Multiple inheritance
 - c) Multi level inheritance
 - d) Hierarchical inheritance
6. Write a program to demonstrate use of implementing interfaces.
7. Write a program to implement interfaces all string operations.
8. Write a program to create student report using applet, read the input using text boxes and display the output using buttons.
9. Write a program to implement thread priorities.
10. Write a program to implement thread, applets and graphics to animate ball movement.
11. JAVA Applet program
 - a) Write a Applet program using paint brush
 - b) Write a program to display analog clock using Applet
 - c) Write a program to create different shapes and fill colors using Applet
12. JAVA Event Handling program
 - a) Write a program that display the x and y position of the cursor movement using Mouse
 - b) Write a program that identifies key-up key-down event user entering text in a Applet
13. JAVA programs on Swings
 - a) Write a program to build a Calculator in Swings
 - b) Write a program to display the digital watch in swing
 - c) Write a program that to create a single ball bouncing inside a JPanel.
 - d) Write a program JTree as displaying a real tree upside down

TOTAL : 45 PERIODS

LAB REQUIREMENTS:

Hardware:

Desktop Systems - Pentium IV with 2 GB RAM
160 GB HARD Disk
Monitor 1024 x 768 colour

Software:

Windows operating system
JDK 1.8

OUTCOMES:

On completion of this laboratory course, the student should be able to

1. Write Java programs in accordance with the object oriented programming concepts. (K6)
2. Design user defined java packages. (K6)
3. Create Java programs using Inheritance and Polymorphism. (K6)
4. Implement Error-handling techniques using Exception handling and Multithreading. (K6)
5. Develop Applet program and GUI using Swing components. (K6)
6. Enumerate the event handling techniques in Java Programming. (K5)

CO- PO, PSO MAPPING :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| C01 | 3 | 2 | 2 | 2 | - | 2 | - | - | - | - | 2 | 2 | 3 | 2 |
| C02 | 2 | 2 | 3 | 2 | - | 2 | - | - | - | - | 2 | 2 | 3 | 2 |
| C03 | 2 | 2 | 3 | 2 | - | 2 | - | - | 2 | 2 | 2 | 2 | 3 | 2 |
| C04 | 3 | 3 | 2 | 2 | - | 2 | - | - | - | - | 2 | 2 | 3 | 2 |
| C05 | 3 | 3 | 3 | 2 | - | 2 | - | - | - | - | 2 | 2 | 3 | 2 |
| C06 | 2 | 3 | 3 | 2 | - | 2 | - | - | 2 | 2 | 2 | 2 | 3 | 2 |

SEMESTER - V

| | | | | | |
|------------------------------|-------------------|---|---|---|---|
| 20CCTE501 SDG NO. 4,11,15 | LIVE-IN-LAB - III | L | T | P | C |
| | | 0 | 0 | 2 | 2 |

OBJECTIVES:

- To provide opportunities for the students, expose to Industrial environment and real time work
- To enable hands-on experience in the electronics hardware/Software domain
- To enable development of skill set for designing and realizing prototype electronic systems/simulation model

COURSE METHODOLOGY:

- This initiative is designed to inculcate ethical principles of research and to get involve in life-long learning process for the students.

- The project work must involve engineering design with realistic constraints. It must also include appropriate elements of the following: Engineering standards, design analysis, modeling, simulation, experimentation, prototyping, fabrication, correlation of data, and software development.
- Project can be individual work or a group project, with maximum of 3 students. In case of group project, the individual project report of each student should specify the individual's contribution to the group project.
- On completion of the project, the student shall submit a detailed project report. The project should be reviewed and the report shall be evaluated and the students shall appear for a viva-voce oral examination on the project approved by the Coordinator and the project guide.

EVALUATION

- First evaluation (Immediately after first internal examination) : 20 marks
- Second evaluation (Immediately after second internal examination): 30marks
- Final evaluation (Last week of the semester) : 50marks

Note: All the three evaluations are mandatory for course completion and for awarding the final grade.

TOTAL: 45 PERIODS

OUTCOMES:

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

- 1 Perform literature survey to identify the gap and an application oriented research problem in the specific domain (K2)
- 2 Design and validate the proposed system using simulation (K3)
- 3 Implement the proposed system (K3)
- 4 Examine the obtained results and prepare a technical report (K4)
- 5 Publish the work in journals and apply for the patents.(K3)
- 6 Prepare for industrial environment and real time work (K3)

CO - PO, PSO MAPPING :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| C01 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 3 | 3 |
| C02 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 |
| C03 | 2 | 2 | 2 | 1 | 2 | 1 | 1 | 1 | 3 | 2 | 3 | 3 | 3 | 2 |
| C04 | 2 | 2 | 2 | 1 | 2 | 1 | 1 | 1 | 3 | 2 | 3 | 3 | 3 | 2 |
| C05 | 2 | 2 | 2 | 1 | 2 | 1 | 1 | 1 | 3 | 2 | 3 | 3 | 3 | 2 |
| C06 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 |

SEMESTER - V

| | | | | | |
|-------------------------------------|--------------------------|----------|----------|----------|----------|
| 20ECTP501 SDG NO. 4,11,15 | SKILL ENHANCEMENT | L | T | P | C |
| | | 0 | 0 | 3 | 1 |

OBJECTIVES:

- Enhance their quantitative ability.
- Enhance their reasoning ability
- Enhance their verbal ability.
- Equip with creative thinking and problem solving skills

UNIT I QUANTITATIVE ABILITY – V**6 Hours**

Square Root And Cube Root, Logarithm, Volume and Surface Area, Permutation and Combination

UNIT II QUANTITATIVE ABILITY – VI**6 Hours**

Probability, Averages, Area, Odd Man Out, Crypt Arithmetic, Flowcharts

UNIT III REASONING ABILITY – III**6 Hours**

Data Interpretation Table Charts, Data Interpretation Bar Charts, Blood Relationship, Puzzles

UNIT IV VERBAL ABILITY – III**6 HOURS**

Spellings, Selecting Words, Spotting Errors, Ordering of Words, Logical Sequence of Words

UNIT V CREATIVITY ABILITY – III**6 Hours**

Logical Puzzles, Playing Cards Puzzles, Clock Puzzles, Number Puzzles, Sudoku

TOTAL : 30 PERIODS**REFERENCES**

- Quantitative Aptitude for Competitive Exams by R. S. Agarwal
- Quantum CAT by Sarvesh Verma
- A Modern Approach to Logical Reasoning by R. S. Agarwal
- Verbal Ability and Reading Comprehension by Arun Sharma

PYTHON PROGRAMMING AND CCNA - PHASE 2**COURSE OBJECTIVES**

To enable students to,

- The course is designed to provide Strong knowledge of Python.
- Python programming is intended for software engineers, system analysts, program managers and user support personnel who wish to learn the Python programming language.
- Understand the basics of configuration and routing in networks.

UNIT I INTRODUCTION, DATATYPES AND STRINGS, LIST & TUPLES**10**

DataTypes - Integer, Float , Boolean , String , List , Tuple , Dictionary and Sets. String - Concatenation and Replication, isalnum functions, Slicing Operation sorted() , reversed() , min() , max() , index() and count() function, packing and unpacking of data in a tuple

UNIT II DICTIONARY AND SETS and HANDLING**10**

Dictionary - del Keyword,. Sets - Frozen sets, Internal working of sets, add() , union() , intersection() and difference() method, symmetric_difference, clear() method, Operators in sets, Higher Order Functions - map , filter , reduce and lambda function, Random Library

UNIT III EXCEPTIONAL HANDLING, REGULAR EXPRESSIONS AND OBJECT ORIENTED PROGRAMMING**10**

Exception Handling - All Error Categories, try , except , finally blocks, Raising an exception, Regular Expression, Object Oriented Programming - Types of Inheritance, Data encapsulation and Abstraction, Polymorphism, Method

OverRiding, Operator overloading, operator overRiding,

UNIT IV CCNA TOPOLOGY AND CONFIGURATION

8

Introduction to Cisco Packet Tracer- Configure the basic switch and router settings- Forming a simple network - Implementing various network topology - Securing switch ports - Configure EtherChannel - Configuration of IPv4 - Configuration of IPv6

UNIT V ROUTING AND NETWORKING

7

Subnetting a network - Implementing static routing - Implementing dynamic routing - Implementing VLAN - Configuring DHCP

TOTAL : 45 HOURS

REFERENCES

- 1 Python-(Mark Lutz)
- 2 Python Training guide (BPB Publications)
- 3 Zobel, Justin (2014), Writing for Computer Science. Third edition. Springer Verlag London Ltd (270 p).

ONLINE RESOURCES

1. <https://www.tutorialandexample.com/ccna-tutorial>
2. <https://www.computernetworkingnotes.com/ccna-study-guide/types-of-static-routes-explained.html>

COURSE OUTCOMES

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

1. Explain basic principles of Python programming language (K2)
2. Implement object oriented concepts (K2)
3. Implement database and GUI applications (K2)
4. Install, configure and operate LAN and WAN services for small networks (K3)
5. Manage Network for a small Organization (K2)

CO - PO - PSO MAPPING

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| C01 | 3 | 2 | 2 | 2 | 3 | 2 | - | 3 | 2 | 3 | - | 2 | - | - |
| C02 | 3 | 3 | 3 | 2 | 3 | 2 | - | 3 | 2 | 3 | - | 2 | - | - |
| C03 | 3 | 2 | 3 | 1 | 2 | 2 | - | - | 1 | 3 | - | 2 | - | - |
| C04 | 3 | 2 | 2 | 2 | 3 | 2 | - | 3 | 3 | 3 | - | 2 | 2 | 2 |
| C05 | 2 | 2 | 2 | 1 | 3 | 2 | - | - | 2 | 3 | - | 2 | 2 | 2 |
| C06 | 3 | 2 | 2 | - | 1 | 2 | - | - | 2 | 3 | - | 2 | 2 | 2 |

SEMESTER - VI

| | | | | | |
|------------------|--|----------|----------|----------|----------|
| 20ECPW501 | DISCRETE TIME SIGNAL PROCESSING | L | T | P | C |
| SDG NO. 4,9 | (With Laboratory Component) | 3 | 0 | 2 | 4 |

OBJECTIVES:

- To learn discrete Fourier transform, fast Fourier transform, properties of DFT and its application to linear filtering
- To understand the characteristics of digital filters, design digital IIR filters and apply these filters to filter undesirable signals in various frequency bands
- To understand the characteristics of digital linear phase FIR filters, design digital FIR filters and apply these filters to filter undesirable signals in various frequency bands
- To understand the effects of finite precision representations on digital filters and obtain knowledge and ability to use the digital Signal Processors to build DSP systems for real time problems
- Perform basic operations on signal processing and design filters using MATLAB, and to study the architecture of DSP Processor and Implement certain DSP algorithms on Digital Signal Processors

UNIT I DISCRETE FOURIER TRANSFORM

9

Summary of analysis & synthesis equations for FT & DTFT, frequency domain sampling, Discrete Fourier transform (DFT) - deriving DFT from DTFT, properties of DFT - periodicity, symmetry, circular convolution. Linear filtering using DFT. Filtering long data sequences - overlap save and overlap add method. Fast computation of DFT - Radix-2 Decimation-in-time (DIT) Fast Fourier transform (FFT), Decimation-in-frequency (DIF), Fast Fourier transform (FFT). Linear filtering using FFT.

UNIT II INFINITE IMPULSE RESPONSE FILTERS

9

Characteristics of practical frequency selective filters, characteristics of commonly used analog filters - Butterworth filters, Chebyshev filters. Design of IIR filters from analog filters (LPE, HPE, BPE, BRP) - Approximation of derivatives, Impulse invariance method, Bilinear transformation. Frequency transformation in the analog domain. Structure of IIR filter - direct form I, direct form II, cascade, parallel realizations.

UNIT III FINITE IMPULSE RESPONSE FILTERS

9

Design of FIR filters - symmetric and Anti-symmetric FIR filters - design of linear phase FIR filters using Fourier series method - FIR filter design using

windows (Rectangular, Hamming and Hanning window), Frequency sampling method. FIR filter structures - linear phase structure, direct form realizations

UNIT IV FINITE WORD LENGTH EFFECTS

9

Fixed point and floating point number representation - ADC - quantization - truncation and rounding - quantization noise - input / output quantization - coefficient quantization error - product quantization error - overflow error - limit cycle oscillations due to product quantization and summation - scaling to prevent overflow.

UNIT V INTRODUCTION TO DIGITAL SIGNAL PROCESSORS

9

DSP functionalities - circular buffering – DSP architecture – Fixed and Floating point architecture principles – Programming – Application examples.

LAB COMPONENT – LIST OF EXPERIMENTS

15

MATLAB / EQUIVALENT SOFTWARE PACKAGE

1. Generation of elementary Discrete-Time sequences, Linear and Circular convolutions, Auto correlation and Cross Correlation.
2. Frequency Analysis using DFT and FFT.
3. Design of FIR filters (LPF/HPF/BPF/BSF) and demonstrates the filtering operation.
4. Design of Butterworth and Chebyshev IIR filters (LPF/HPF/BPF/BSF) and demonstrate the filtering operations.

DSP PROCESSOR BASED IMPLEMENTATION

1. Study of architecture of Digital Signal Processor and Perform MAC operation using various addressing modes.
2. Generation of signals – Square, Triangular, Sawtooth.
3. Convolution.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. John G Proakis and Manolakis, “Digital Signal Processing Principles, Algorithms and Applications”, Pearson, Fifth Edition, 2021.
2. A.V.Oppenheim, R.W. Schafer and J.R. Buck, “Discrete Time Signal Processing”, Eighth Indian Reprint, Pearson, 2004.

REFERENCES:

1. Emmanuel C. Ifeachor & Barrie. W. Jervis, “Digital Signal Processing”, Second Edition, Pearson Education / Prentice Hall, 2002.
2. Sanjit K. Mitra, “Digital Signal Processing – A Computer Based Approach”,

Tata McGraw Hill, 2007.

3. Andreas Antoniou, "Digital Signal Processing", Tata Mc Graw Hill, 2006.
4. K. P. Soman and K. I. Ramachandran, "Insight into Wavelets - From Theory to Practice", Prentice Hall of India, Third Edition, 2010.
5. B. Venkataramani, M. Bhaskar, "Digital Signal Processors: Architecture, Programming and Application", Tata McGraw Hill Education, 2002.

WEB REFERENCES:

1. https://www.tutorialspoint.com/digital_signal_processing/index.htm
2. <https://www.analog.com/en/design-center/landing-pages/001/beginners-guide-to-dsp.html>
3. <https://101science.com/dsp.htm>

ONLINE RESOURCES:

1. https://swayam.gov.in/nd1_noc20_ee31<https://nptel.ac.in/courses/117105134/>
2. <https://nptel.ac.in/courses/117105134/>
3. <https://www.edx.org/course/discrete-time-signal-processing-4>

OUTCOMES:

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

1. Analyse the signals in frequency domain using DFT and FFT algorithm. (K4).
2. Perform Linear filtering to demonstrate the output response of a system and characterize frequency selective filters. (K3)
3. Design digital IIR and FIR to select specific frequency components present in the signal. (K4)
4. Select appropriate realization structure for various filters and characterize the effects of finite word length in filters. (K4)
5. Analyse the errors due to quantization and realize the architecture of digital signal processors. (K4)
6. Execute basic signal processing operations and design filters using MATLAB / EQUIVALENT SOFTWARE and analyze the architecture and design DSP system for various applications of DSP Processor. (K4)

CO - PO, PSO MAPPING :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| C01 | 3 | 2 | 1 | 1 | 3 | - | - | - | 1 | - | - | 2 | 3 | - |
| C02 | 3 | 3 | 2 | 2 | 2 | - | - | - | 1 | - | - | 3 | 3 | 2 |
| C03 | 3 | 1 | 2 | 1 | 2 | - | - | - | 1 | - | - | 3 | 3 | 1 |
| C04 | 3 | 2 | 2 | 3 | 2 | 2 | - | - | 1 | - | - | 3 | 3 | 2 |
| C05 | 3 | 3 | 2 | 2 | 2 | 2 | - | - | - | - | - | 3 | 3 | 2 |
| C06 | 3 | 3 | 2 | 2 | 2 | 2 | - | - | - | - | 3 | 2 | 3 | 2 |

SEMESTER - VI

| | | | | | |
|-------------------------------|---|----------|----------|----------|----------|
| 20CSPC403 SDG NO. 4 | OBJECT ORIENTED SOFTWARE ENGINEERING | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To address the real time complex Engineering problems using innovative approaches with strong core computing skills
- To apply Core-analytical knowledge and appropriate techniques and provide solutions to real time challenges of National and Global society
- To understand the concepts of OOAD and Design projects using UML diagrams
- To improve the Software Design with Design Patterns

UNIT I SOFTWARE PROCESS AND AGILE DEVELOPMENT 9

Introduction to Software Engineering - Software Process - Perspective and Specialized Process Models - Introduction to Agility-Agile process-Extreme Programming-XP Process.

UNIT II REQUIREMENTS ANALYSIS AND SOFTWARE DESIGN 9

Software Requirements: Functional And Non-Functional - User Requirement - System Requirements - Software Requirements Document - Requirement Engineering Process - Feasibility Studies - Requirements Elicitation and Analysis -Requirements Validation - Requirements Management - Design Process - Design Concepts - Design Model - Design Heuristic - Architectural Design -Architectural Styles - Architectural Design - Architectural Mapping using Data Flow.

UNIT III STATIC AND DYNAMIC UML DIAGRAMS**9**

Introduction To OOAD with OO Basics-Unified Process-Usecase – Case Study-The Next Gen Pos System, Inception –Use Case Modeling - Relating Use Cases-Include, Extend And Generalization-Class Diagram-Elaboration-Domain Model-Finding Conceptual Classes And Description Classes-Associations-Attributes-Aggregation And Composition-Dynamic Diagrams-UML Interaction Diagrams-System Sequence Diagram-Collaboration Diagram-State Machine Diagram And Modeling-Activity Diagram.

UNIT IV IMPLEMENTATION UML DIAGRAMS AND DESIGN PATTERNS 9

Implementation Diagrams-Package Diagram-Component and Deployment Diagrams - GRASP: Designing Objects with Responsibilities - Creator - Information Expert - Low Coupling-High Cohesion-Controller Design Patterns - Creational - Factory Method - Structural - Bridge - Adapter - Behavioral-Strategy-Observer-Applying GoF Design Patterns-Mapping Design to Code.

UNIT V TESTING AND MAINTENANCE**9**

Software Testing Fundamentals-Internal And External Views of Testing-White Box Testing – Basis Path Testing - Control Structure Testing - Black Box Testing- Regression Testing – 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**TEXT BOOKS:**

1. Roger S. Pressman, “Software Engineering – A Practitioner's Approach”, Sixth Edition, McGraw Hill International Edition, 2005
2. Craig Larman, “Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development”, Third Edition, Pearson Education, 2005.

REFERENCES:

1. Rajib Mall, “Fundamentals of Software Engineering”, Third Edition, PHI Learning Private Limited, 2009.
2. Pankaj Jalote, “Software Engineering, A Precise Approach”, Wiley India, 2010.
3. Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides, “Design patterns: Elements of Reusable Object-Oriented Software”, Addison-Wesley, 1995.

4. Martin Fowler, "UML Distilled: A Brief Guide to the Standard Object Modeling Language", Third edition, Addison Wesley, 2003.
5. Ian Sommerville, "Software Engineering", Seventh Edition, Pearson Education Asia, 2007.
6. Ali Bahrami, "Object Oriented Systems Development", McGraw Hill International Edition, 1999.

WEB REFERENCES:

1. https://swayam.gov.in/nd1_noc19_cs69/preview
2. <https://nptel.ac.in/noc/courses/noc19/SEM2/noc19-cs69>
3. <https://nptel.ac.in/courses/106/105/106105182/>
4. https://en.wikipedia.org/wiki/Object-oriented_analysis_and_design
5. https://www.tutorialspoint.com/object_oriented_analysis_design/ood_object_oriented_analysis.htm

ONLINE RESOURCES:

1. http://www.vssut.ac.in/lecture_notes/lecture1428551142.pdf
2. <https://freevideolectures.com/course/2318/software-engineering>
3. <https://courses.cs.washington.edu/courses/cse403/01au/lectures/>
4. <https://cosmolearning.org/courses/introduction-to-software-engineering/video-lectures/>
5. <https://www.ece.rutgers.edu/~marsic/books/SE/instructor/slides/>

OUTCOMES:**Upon completion of the course, the student should be able to**

1. Identify the key activities in managing a software project and Compare different process models. (K1)
2. Understand Concepts of requirements engineering and Analysis Modeling. (K2)
3. Apply systematic procedure for software design and deployment. (K3)
4. Compare and contrast the various testing and maintenance. (K5)
5. Express software design with UML diagrams. (K2)
6. Convert UML based software design into pattern based design using design patterns. (K3)

CO- PO, PSO MAPPING:

1. Identify the key activities in managing a software project and Compare different process models. (K1)
2. Understand Concepts of requirements engineering and Analysis Modeling. (K2)
3. Apply systematic procedure for software design and deployment. (K3)
4. Compare and contrast the various testing and maintenance. (K5)
5. Express software design with UML diagrams. (K2)
6. Convert UML based software design into pattern based design using design patterns. (K3)

CO - PO, PSO MAPPING:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| C01 | 3 | 2 | - | 2 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | - | - | 3 |
| C02 | 3 | 2 | - | 2 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | - | - | 3 |
| C03 | 3 | 2 | - | 3 | 3 | 3 | 3 | 1 | 3 | 3 | 3 | 1 | 1 | 3 |
| C04 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 2 |
| C05 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 2 |
| C06 | 3 | 2 | - | 2 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | - | - | 3 |

SEMESTER - VI

| | | | | | |
|-------------------------------|--------------------------------|----------|----------|----------|----------|
| 20CSPC601 SDG NO. 4 | ARTIFICIAL INTELLIGENCE | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To understand the various characteristics of Intelligent agents
- To learn the different search strategies in AI
- To learn to represent knowledge in solving AI problems
- To understand the different ways of designing software agents and about the various applications of AI

UNIT I INTRODUCTION**9**

Introduction - Definition - Future of Artificial Intelligence – Characteristics of Intelligent Agents – Typical Intelligent Agents – Problem Solving Approach to Typical AI Problems – Search Strategies - Uninformed - Heuristics - Informed.

UNIT II PROBLEMSOLVING METHODS**9**

Local Search Algorithms and Optimization Problems - Searching with Partial Observations – Constraint Satisfaction Problems – Constraint Propagation - Backtracking Search - Game Playing – Optimal Decisions in Games – Alpha-Beta Pruning - Stochastic Games.

UNIT III REPRESENTATION OF KNOWLEDGE**9**

First Order Predicate Logic – Prolog Programming – Unification – Forward Chaining - Backward Chaining – Resolution – Knowledge Representation - Ontological Engineering - Categories and Objects - Events - Mental Events and Mental Objects - Reasoning Systems for Categories - Reasoning with Default Information.

UNIT IV PLANNING AND LEARNING**9**

Planning – Planning with State Space Search- Partial Order Planning Algorithm – Planning Graphs - Logical Formulation of Learning - Knowledge in Learning - Explanation-based Learning - Learning using Relevance Information.

UNIT V NATURAL LANGUAGE PROCESSING**9**

Language models - Phrase Structure Grammars - Syntactic Analysis – Augmented Grammars and Semantic Interpretation - Application with NLP: Developing a Simple Chatbot - Types of Chatbot.

TOTAL: 45 PERIODS**TEXT BOOKS:**

- 1 Stuart J Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", Prentice Hall, Third Edition, 2009.
- 2 Elaine Rich, Kevin Knight, Shivashankar B. Nair, "Artificial Intelligence", Tata McGraw-Hill Education, Third Edition, 2008.

REFERENCES:

1. M. Tim Jones, "Artificial Intelligence: A Systems Approach(Computer Science)", Jones and Bartlett Publishers, Inc.; First Edition, 2008.
2. Nils J. Nilsson, "The Quest for Artificial Intelligence", Cambridge University Press, 2009.
3. William F. Clocksin and Christopher S. Mellish, "Programming in Prolog: Using the ISO Standard", Springer, Fifth Edition, 2003.
4. George F Luger, "Artificial Intelligence: Structures and Strategies for Complex Problem Solving", Pearson Education, New Delhi, Fifth Edition, 2017.

5. Steven Bird, Ewan Klein and Edward Loper, "Natural Language Processing with Python", O'Reilly, 2009, <https://www.nltk.org/book/>.
6. I. Bratko, "Prolog: Programming for Artificial Intelligence", Addison-Wesley Educational Publishers Inc., Fourth Edition, 2011.

WEB REFERENCES:

1. <https://books.google.co.in/books?id=uSvYmki2yg0C&printsec=frontcover&dq=Supervised+Learning&hl=en&sa=X&ved=0ahUKEwigkNa1xN3oAhWawjgGHe8hAzoQ6AEIKDAA#v=onepage&q=Supervised%20Learning&f=false>

OUTCOMES:

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

1. Infer the agent characteristics and its problem solving approaches.(K2)
2. Select appropriate search algorithms for any AI problem.(K1)
3. Apply the principles of AI in game playing.(K3)
4. Construct and solve a problem using first order and predicate logic.(K3)
5. Identify the methods of solving problems using planning and learning.(K3)
6. Implement applications for Natural Language Processing that use Artificial Intelligence.(K3)

CO- PO, PSO MAPPING:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 2 | 3 | 2 | 3 | 2 | 1 | 1 | - | 1 | - | - | 1 | 2 | 3 |
| CO2 | 2 | 3 | 2 | 3 | 2 | 1 | 1 | - | 1 | - | - | 1 | 3 | 3 |
| CO3 | 2 | 3 | 2 | 3 | 2 | 1 | 1 | - | 1 | - | - | 1 | 3 | 2 |
| CO4 | 2 | 3 | 2 | 3 | 2 | 1 | 1 | - | 1 | - | - | 1 | 3 | 3 |
| CO5 | 2 | 3 | 2 | 3 | 3 | 1 | 1 | - | 2 | - | - | 1 | 2 | 2 |
| CO6 | 2 | 3 | 2 | 3 | 3 | 1 | 1 | - | 2 | - | - | 1 | 2 | 3 |

SEMESTER - VI

| | | | | | |
|-------------------------------|---|----------|----------|----------|----------|
| 20CCPC601 SDG NO. 4 | WIRELESS COMMUNICATION AND COMPUTING WITH LABORATORY | L | T | P | C |
| | | 3 | 0 | 2 | 4 |

OBJECTIVES:

- To learn the basic concepts of wireless communication.
- To learn the concepts of cellular networks.
- To understand about multiple access in wireless system.
- To learn about IEEE standards.
- To learn the concepts of Bluetooth

UNIT I INTRODUCTION

9

Introduction, Transmission Fundamentals-Signals for Conveying Information, Analog and Digital Data Transmission, Channel Capacity, Transmission Media, Multiplexing Communication networks LANs, MANs, and WANs, Switching Techniques, Circuit Switching, Packet Switching, Protocols and the TCP/IP Suite-Need for a Protocol Architecture, TCP/IP Protocol Architecture, OSI Model, Internetworking.

UNIT II CELLULAR WIRELESS NETWORKS

9

Principles of Cellular Networks, First Generation Analog Second-Generation TDMA Second-Generation CDMA, Third-Generation Systems Antennas and Propagation-Antennas, Propagation Modes, Line-of Sight Transmission, Fading in the Mobile Environment Modulation Techniques-Signal Encoding Criteria, Digital Data- Analog Signals, Analog Data-Analog Signals, Analog Data-Digital Signals Spread Spectrum-The Concept of Spread Spectrum, Frequency Hopping Spread Spectrum, Direct Sequence Spread Spectrum, Code Division Multiple Access, Coding and Error Control-Error Detection, Block Error Correction Codes, Convolution Codes, Automatic Repeat Request

UNIT III MULTIPLE ACCESS IN WIRELESS SYSTEM

9

Multiple access scheme-FDMA, TDMA, CDMA, SDMA, packet radio access, multiple access with collision avoidance. Global system for mobile communication - Global system for mobile communication, GSM architecture, GSM entities, call routing in GSM, PLMN interface, GSM addresses and identifiers, network aspects in GSM, GSM frequency allocation, authentication and security General packet radio service (GPRS) and packet data network, GPRS- network architecture, network operation, data services, Applications, Billing and charging in GPRS Wireless System Operations and standards - Cordless Systems, Wireless Local Loop, Wi-MAX and IEEE 802.16 Broadband Wireless Access Standards Mobile IP and Wireless Application.

UNIT IV IEEE STANDARDS**9**

Wi-Fi and the IEEE 802.11 Wireless LAN Standard – IEEE 802 architecture, IEEE 802.11 architecture and services, IEEE 802.11 Medium access control, IEEE 802.11 physical layer, Wi-Fi protected access.

UNIT V BLUETOOTH**9**

Bluetooth - Radio specification, baseband specification, link manager specification, logical link control and adaptation protocol.

LIST OF EXPERIMENTS**15**

- 1 Wireless Channel Simulation including fading effects
- 2 Wireless Channel Simulation including Doppler effects.
- 3 Simulation of Channel Estimation, Synchronization
- 4 Simulation of Equalization techniques.
- 5 Analyzing Impact of Pulse Shaping and Matched Filtering using Software Defined Radios.
- 6 OFDM Signal Transmission using Software Defined Radios.
- 7 OFDM Signal Reception using Software Defined Radios.

TOTAL: 60 PERIODS**TEXT BOOKS:**

1. Wireless Communications & Networks, Second Edition, William Stallings by Pearson
2. Mobile Computing Technology, Applications and service creation, Asoke K Telukder, Roopa R Yavagal by TMH

REFERENCES:

1. Wireless and mobile networks, Dr. Sunilkumar S. Manvi, Dr. Mahabaleshwar S. Kakkasageri by WILEY Wireless networks, P. Nicopolitidis, M.S. Obaidat, G.I. Papadimitriou, A.S. Pomportsis by WILEY
2. Mobile Computing, Raj Kamal by Oxford
3. Mobile Computing Theory and Practice-Kumkum Garg-Pearson
4. Wireless Communications & Networks, Second Edition, William Stallings by Pearson

WEB REFERENCES:

1. https://www3.nd.edu/~cpoellab/teaching/cse40814_fall08/Lesson1.pdf
2. https://www.cse.wustl.edu/~jain/refs/wir_refs.htm

ONLINE RESOURCES:

1. <https://onlinelibrary.wiley.com/doi/pdf/10.1002/9780470167960.fmatter>

OUTCOMES:

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

1. Summarize the Concepts of Networks (K2)
2. Interpret the Concepts of Cellular Wireless Networks.(K2)
3. Understand the Concepts of Multiple Access in Wireless System.(K2)
4. Interpret the Concepts of IEEE Standards (K2)
5. Understand the working of Bluetooth. (K2)
6. Implementation of Wireless Simulation and OFDM Transmission and Reception (K3)

CO - PO, PSO MAPPING:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 3 | 2 | 2 | 2 | 1 | 1 | - | 2 | 3 | 2 | 2 | 3 | 2 |
| CO2 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | - | 2 | 3 | 3 | 3 | 3 | 2 |
| CO3 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | - | 3 | 2 | 3 | 2 | 3 | 3 |
| CO4 | 3 | 2 | 2 | 2 | 3 | 2 | 2 | - | 3 | 2 | 2 | 2 | 2 | 2 |
| CO5 | 3 | 3 | 2 | 3 | 2 | 1 | 2 | - | 2 | 2 | 2 | 1 | 3 | 2 |
| CO6 | 3 | 2 | 2 | 2 | 3 | 2 | 2 | - | 3 | 2 | 2 | 2 | 2 | 2 |

SEMESTER - VI

| | | | | | |
|--|--|----------|----------|----------|----------|
| 20HSPL501 SDG NO. 4,8 | COMMUNICATION AND SOFT SKILLS LAB | L | T | P | C |
| | | 0 | 0 | 2 | 1 |

OBJECTIVES:

- To develop effective communication and presentation skills
- To enhance the employability and career skills of the learners
- To enable the learners for preparing job application and e-portfolio
- To make the learners use soft skills efficiently
- To develop their confidence and help them in attending interviews successfully

UNIT I LISTENING AND SPEAKING SKILLS 6

Conversational skills participate in formal and informal talks – general, – group discussion – time management – group dynamics – GD strategies – making effective presentations – listening/watching interviews conversations, documentaries – listening to lectures, discussions from social media – improving articulation.

UNIT II ADVANCED READING AND WRITING SKILLS 6

Reading different genres of texts – writing job applications – cover letter – résumé – emails – memos – writing abstracts – summaries – interpreting visual texts.

UNIT III SKILLS FOR COMPETITIVE EXAMS 6

Reading passages for competitive exams – language focus exercise – building vocabulary tasks – FAQs related to competitive exams – current affairs – improving global reading skills – elaborating ideas – summarizing – understanding arguments – identifying opinion/attitude and making inferences – critical reading.

UNIT IV SOFT SKILLS 6

Motivation – emotional intelligence – managing changes – stress management – leadership traits – team work – career planning – intercultural communication – creative and critical thinking

UNIT V INTERVIEW SKILLS 6

Different types of interview – personal interview – panel interview – telephone/online interview – interview etiquette – answering questions – offering information – mock interviews – FAQs related to job interviews

TOTAL: 30 PERIODS

REFERENCES:

1. Business English Certificate Materials, Cambridge University Press.
2. Comfort, Jeremy, et al. Speaking Effectively: Developing Speaking Skills for Business English. Cambridge University Press, Cambridge, 2011.
3. International English Language Testing System Practice Tests, Cambridge University Press.
4. Personality Development (CD-ROM), Times Multimedia, Mumbai.

WEB REFERENCES:

1. <http://www.slideshare.net/rohitjsh/presentation-on-group-discussion>
2. <http://www.oxforddictionaries.com/words/writing-job-applications>
3. <http://www.skillsyouneed.com/ips/interview-skills.html>
4. <http://www.personalitydevelopment.org/>

5. <https://nptel.ac.in/courses/109/107/109107121/>
6. https://swayam.gov.in/nd1_noc19_hs33/preview
7. <https://ict.iitk.ac.in/courses/enhancing-soft-skills-and-personality/>

ONLINE RESOURCES:

1. <https://www.britishcouncil.my/english/courses-adults/learning-tips/importance-of-soft-skills>
2. <https://www.skillsoft.com/content-solutions/business-skills-training/soft-skills-training/>

OUTCOMES:

Upon completion of the course learners should be able to

1. Demonstrate a better understanding of the communication process by articulating effectively(K2)
2. Exhibit soft skills & technical skills and construct e-portfolio effectively(K3)
3. Apply critical thinking abilities and perform well in group discussions(K2)
4. Adapt the skills towards grooming as a professional continuously(K2)
5. Identify different types of personal interview skills through mock interviews and practices(K2)
6. Execute the employability and career skills in their chosen profession(K3)

CO - PO MAPPING:

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

SEMESTER - VI

| | | | | | |
|-------------------------------|---|----------|----------|----------|------------|
| 20CSPL601 SDG NO. 4 | ARTIFICIAL INTELLIGENCE LABORATORY | L | T | P | C |
| | | 0 | 0 | 3 | 1.5 |

OBJECTIVES:

- To learn Prolog Program
- To Implement in Prolog, C and its working environment
- To Implement N-Queen problem and puzzle problem using Prolog
- To Analyze the problem using BFS and DFS algorithm

LIST OF EXPERIMENTS :

1. Study of Prolog.
2. Write simple fact for the statements using Prolog.
3. Write predicates - one converts centigrade temperature to Fahrenheit, other checks if a temperature is below freezing.
4. Write a program to solve 4-Queen problem.
5. Write a program to solve 8-Puzzle problem.
6. Write a program to solve any problem using Breadth First Search.
7. Write a program to solve any problem using Depth First Search.
8. Write a program to solve Travelling Salesman Problem.
9. Write a program to solve Water Jug problem.
10. Write a program to solve Missionaries and Cannibal problem.
11. Write a program to implement Library Management System.

TOTAL: 45 PERIODS

LAB REQUIREMENTS :

SOFTWARE : Prolog, Turbo C

OUTCOMES:

On completion of this laboratory course, the student should be able to

- 1 Interpret the concepts of Turbo and Prolog programming in AI. (K3)
- 2 Examine First order predicate logic to solve AI problems. (K4)
- 3 Apply Informed search strategies to solve AI problems. (K3)
- 4 Apply Uninformed search strategies to solve AI problems. (K3)
- 5 Select State Space Searching method to solve AI problems. (K3)
- 6 Demonstrate an application using Natural Language Processing. (K3)

CO - PO, PSO MAPPING:

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

SEMESTER - VI

| | | | | | |
|--------------------------------|---------------------------|---|---|---|---|
| 20CCPJ601 SDG NO. 4, 11, 15 | INNOVATIVE DESIGN PROJECT | L | T | P | C |
| | | 0 | 0 | 2 | 1 |

OBJECTIVES:

- To understand the engineering aspects of design with reference to simple products
- To foster innovation in design of products
- To develop design that add value to products and solve technical problems.
- To create awareness among the students of the characteristics of several domain areas where IT can be effectively used

COURSE PLAN:

Study: Take minimum three simple products, processes or techniques in the area of specialization, study, analyze and present them. The analysis shall be focused on functionality, construction, quality, reliability, safety, maintenance, handling, sustainability, cost etc. whichever are applicable. Each student in the group has to present individually; choosing different products, processes or techniques.

Design: The project team shall identify an innovative product, process or technology and proceed with detailed design. At the end, the team has to document it properly and present and defend it. The design is expected to concentrate on functionality; design for strength is not expected.

Note: The one hour/week allotted for tutorial shall be used for discussions and presentations. The project team (not exceeding four) can be students from different branches, if the design problem is multidisciplinary.

EVALUATION:

1. First evaluation (Immediately after first internal examination) : 20 marks
2. Second evaluation (Immediately after second internal examination): 20 marks
3. Final evaluation (Last week of the semester) : 60 marks

Note: All the three evaluations are mandatory for course completion and for awarding the final grade.

OUTCOMES:

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

1. Understand how to approach innovation challenges from a human-centred perspective [K2]
2. develop many creative ideas through structured brainstorming sessions [K3]
3. Apply the perspectives of different people that lead to best innovations [K3]
4. Comprehend the importance of incorporating multidisciplinary approach that address human needs and sustainable development [K3]
5. The significance of developing innovation projects with a prototyping mind set, where iterations, trial and error, and even failure are all part of a valuable, creative learning process [K4]

CO- PO, PSO MAPPING:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| C01 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 2 | 3 | 3 |
| C02 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 2 | 3 | 3 |
| C03 | 2 | 2 | 2 | 1 | 2 | 1 | 1 | 1 | 3 | 2 | 3 | 3 | 3 | 2 |
| C04 | 2 | 2 | 2 | 1 | 2 | 1 | 1 | 1 | 3 | 2 | 3 | 3 | 3 | 2 |
| C05 | 2 | 2 | 2 | 1 | 2 | 1 | 1 | 1 | 3 | 2 | 3 | 3 | 3 | 2 |

SEMESTER - VI

| | | | | | |
|-------------------------------------|--------------------------|----------|----------|----------|----------|
| 20CCTP601 SDG NO. 4,11,15 | SKILL ENHANCEMENT | L | T | P | C |
| | | 0 | 0 | 2 | 1 |

APTITUDE & COGNITIVE SKILLS – PHASE 1

OBJECTIVES:

- Enhance their quantitative ability.
- Enhance their reasoning ability
- Enhance their verbal ability.

UNIT I QUANTITATIVE ABILITY – VII 6

Races And Games, Boats and Streams, Surds and Indices, Pipes and Cistern, Alligations And Mixtures

UNIT II QUANTITATIVE ABILITY – VIII 6

Numbers, Problems on Numbers, Pick Wrong Number, Missing Number, Areas, Shapes, Perimeter.

UNIT III REASONING ABILITY – IV 6

Data Interpretation Pie Charts, Data Interpretation Line Charts, Data Sufficiency (DS), Data Arrangements, LR – Arrangements, LR – Ranking.

UNIT IV VERBAL ABILITY – IV 6

Sentence Correction, Sentence Improvement, Completing Statements, Sentence Formation, Paragraph Formation.

UNIT V CREATIVITY ABILITY – IV 6

Dot Situation, Rule Detection, Embedded Images, Grouping Of Images, Image Analysis.

TOTAL : 30 PERIODS

REFERENCES

- Quantitative Aptitude for Competitive Exams by R. S. Agarwal
- Quantum CAT by Sarvesh Verma
- A Modern Approach to Logical Reasoning by R. S. Agarwal
- Verbal Ability and Reading Comprehension by Arun Sharma

PROBLEM SOLVING USING BASIC DATA STRUCTURES AND TENSOR FLOW – PHASE 2

COURSE OBJECTIVES

To enable students to

- The objective of the course is to familiarize students with basic data structures and their use in fundamental algorithms.
- Understand the basic and advanced concept of machine learning and deep learning

UNIT I LINKED LIST & STACK, QUEUE & HEAP 10

Linked List - Doubly Linked List Traversal, Circular Linked List, Structure, Node creation, Traversal Stack, Stack -Time Complexities of the Operations, Infix to Postfix/Prefix Conversation, Histogram Problem, Implementation - Using Array, Using Linked List, Queue Implementation - Queue using Stack

UNIT II BINARY TREE AND HASHING 10

Binary Tree - Types of Binary Tree, Balanced Tree, Degenerate or pathological Tree, Binary Search Tree, Inorder , Preorder , PostOrder and LevelOrder Traversal, Hashing, Linear Probing for Collision Handling, Union and Intersection of two Linked Lists

UNIT III TREES AND GRAPH 10

AVL Tree -Right-Left Imbalance, Left and Right Rotation, - Red Black Tree, Rules of coloring Left and Right Rotation, Graph terminology –Representation of graphs –Path matrix –Graph Traversal –BFS (breadth first search) –DFS (depth first search) –Minimum spanning Tree –Kruskal's Algorithm & Prim's Algorithm –Warshall's algorithm (shortest path algorithm).

UNIT IV BASICS OF TENSOR FLOW 8

Tensors- Create a Tensor - Tensor Operations - The nn.Module -A word about Layers - Datasets and DataLoaders - Understanding Custom Datasets - Understanding Custom DataLoaders.

UNIT V TRAINING A NEURAL NETWORK 7

Training a Neural Network - Loss functions - Custom Loss Function - Optimizers - Using GPU/Multiple GPUs

TOTAL : 45 PERIODS

REFERENCES

1. Weiss, Mark. A. (2012), Data structures and algorithm analysis in Java. 3 edition. Harlow, Essex : Pearson (632 p).
2. Zobel, Justin (2014), Writing for Computer Science. 3 edition. Springer Verlag London Ltd (270 p).

ONLINE RESOURCES

1. <https://www.tensorflow.org/guide/basics>
2. <https://www.javatpoint.com/tensorflow-introduction>

COURSE OUTCOMES

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

1. Understand Data abstraction and information hiding. (K2)
2. Learn linear data structures and their applications in problem solving and programming. (K3)
3. Learn nonlinear data structures and their applications in problem solving and programming. (K3)
4. Understand Internal and external sort and search techniques. (K2)
5. Synthesize efficient algorithms in common engineering design situations. (K3)
6. Train and run the deep neural networks (K3)

CO – PO, PSO MAPPING:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| C01 | 3 | 2 | 2 | 2 | | - | - | - | - | - | 1 | 2 | 3 | 2 |
| C02 | 3 | 3 | 3 | 2 | - | - | - | - | - | - | 1 | 2 | 3 | 2 |
| C03 | 3 | 2 | 3 | 2 | - | - | - | - | - | - | 1 | 1 | 3 | 2 |
| C04 | 3 | 2 | 2 | 2 | - | - | - | - | - | - | 1 | 2 | 3 | 2 |
| C05 | 2 | 2 | 2 | 1 | - | - | - | - | - | - | 2 | 2 | 3 | 2 |
| C06 | 3 | 2 | 2 | 2 | - | - | - | - | - | - | 2 | 2 | 3 | 2 |

SEMESTER - VII

| | | | | | |
|-------------------------------|---|----------|----------|----------|----------|
| 20CCPW701 SDG NO. 9 | CRYPTOGRAPHY AND NETWORK SECURITY (WITH LAB) | L | T | P | C |
| | | 3 | 0 | 2 | 4 |

OBJECTIVES:

- To understand Cryptography Theories, Algorithms and Systems.
- To understand necessary Approaches and Techniques to build protection mechanisms in order to secure computer networks.
- To understand Cryptography Theories, Algorithms and Systems.

UNIT I INTRODUCTION

9

Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security Cryptography Concepts and Techniques: Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, steganography, key range and key size, possible types of attacks.

UNIT II: SYMMETRIC KEY CIPHERS

9

Block Cipher principles, DES, AES, Blowfish, RC5, IDEA, Block cipher operation, Stream ciphers, RC4. Asymmetric key Ciphers: Principles of public key cryptosystems, RSA algorithm, Elgamal Cryptography, Diffie-Hellman Key Exchange, Knapsack Algorithm.

UNIT III CRYPTOGRAPHIC HASH FUNCTIONS

9

Message Authentication, Secure Hash Algorithm (SHA-512), Message authentication codes: Authentication requirements, HMAC, CMAC, Digital signatures, Elgamal Digital Signature Scheme. Key Management and Distribution: Symmetric Key Distribution Using Symmetric & Asymmetric Encryption, Distribution of Public Keys, Kerberos, X.509 Authentication Service, Public – Key Infrastructure.

UNIT IV NETWORK AND INTERNET SECURITY

9

Electronic Mail security – PGP, S/MIME – IP security – Web Security - SYSTEM SECURITY: Intruders – Malicious software – viruses – Firewalls - Network Access Control and Cloud Security – Transport Level Security – Wireless Network Security – Email Security – IP Security.

UNIT V LAB COMPONENT – LIST OF EXPERIMENTS**24**

1. Write a C program that contains a string (char pointer) with a value \Hello World'. The program should XOR each character in this string with 0 and displays the result.
2. Write a C program that contains a string (char pointer) with a value \Hello World'. The program should AND or and XOR each character in this string with 127 and display the result.
3. Write a Java program to perform encryption and decryption using the following algorithms:
a) Ceasar Cipher b) Substitution Cipher c) Hill Cipher
4. Write a Java program to implement the DES algorithm logic
5. Write a Java program to implement RSA algorithm
6. Implement the Diffie-Hellman Key Exchange mechanism using HTML and JavaScript. Consider the end user as one of the parties (Alice) and the JavaScript application as other party (bob).

TEXT BOOKS:

1. Cryptography and Network Security – Principles and Practice: William Stallings, Pearson Education, 6th Edition
2. Cryptography and Network Security: Atul Kahate, Mc Graw Hill, 3rd Edition

REFERENCE BOOKS:

1. Cryptography and Network Security: C K Shyamala, N Harini, Dr T R Padm anabhan, Wiley India, 1st Edition.
2. Cryptography and Network Security :Forouzan Mukhopadhyay, Mc Graw Hill, 3rd Edition
3. Information Security, Principles, and Practice: Mark Stamp, Wiley India.
4. Principles of Computer Security: WM. Arthur Conklin, Greg White, TMH
5. Introduction to Network Security: Neal Krawetz, CENGAGE Learning
6. Network Security and Cryptography: Bernard Menezes, CENGAGE Learning

OUTCOMES:**Upon completion of the course, the student should be able to:**

1. Understand the concepts of Network Security and Remember the various mathematical techniques applied in Cryptography (K2)
2. Apply the Symmetric and Asymmetric Cryptographic methods and design Secure Applications to operate Digital Signature in Real World Situation. (K3)

- Analyze the Security Architecture and the authentication requirements to identify the vulnerability of the Internet systems in designing the firewalls for E-commerce applications and resolve it. (K3)
- Evaluate the Authentication Applications with different system security tools and recognize the mechanisms of the attacks, and apply them to design and evaluate counter-measure tools (K3)
- Create secured coding in design principles and identify various intrusion detection systems to achieve highest system security (K3)

CO - PO, PSO MAPPING:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| C01 | 3 | 2 | 1 | 1 | 3 | - | - | - | 1 | - | - | 2 | 3 | - |
| C02 | 3 | 3 | 2 | 2 | 2 | - | - | - | 1 | - | - | 3 | 3 | 2 |
| C03 | 3 | 1 | 2 | 1 | 2 | - | - | - | 1 | - | - | 3 | 3 | 1 |
| C04 | 3 | 2 | 2 | 3 | 2 | 2 | - | - | 1 | - | - | 3 | 3 | 2 |
| C05 | 3 | 3 | 2 | 2 | 2 | 2 | - | - | - | - | 3 | 2 | 3 | 2 |

SEMESTER - VII

| | | | | | |
|-------------------------------|---------------------------|----------|----------|----------|----------|
| 20CSPC701 SDG NO. 9 | BIG DATA ANALYTICS | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To describe the basic concepts of Big Data Characteristics and Analytics
- To examine the Hadoop and MapReduce framework for processing large volume of data sets
- To demonstrate Hive, Pig, MongoDB and Report generation
- To analyze the Big Data for useful Business applications and get familiarized with the Visualization

UNIT I INTRODUCTION TO BIG DATA ANALYTICS**9**

Classification of Digital Data - Introduction to Big Data: Characteristics – Evolution – Definition - Challenges with Big Data - Other Characteristics of Data - Why Big Data - Traditional Business Intelligence versus Big Data - Data Warehouse and Hadoop Environment - Big Data Analytics: Classification of Analytics – Challenges - Big Data Analytics importance - Data Science - Data Scientist - Terminologies used in Big Data Environments - Basically Available Soft State Eventual Consistency - Top Analytics Tools.

UNIT II HADOOP AND MAPREDUCE PROGRAMMING 9

Hadoop: Features – Advantages – Versions – Ecosystems – Distributions – Hadoop Versus RDBMS - Distributed Computing Challenges – History - Hadoop Overview - Use Case of Hadoop - Hadoop Distributors - Hadoop Distributed File System - Processing Data with Hadoop - Managing Resources and Applications with Hadoop YARN - Interacting with Hadoop Ecosystem – MapReduce: Mapper – Reducer – Combiner – Partitioner – Searching – Sorting – Compression.

UNIT III DATA PROCESSING SERVICES: HIVE & PIG 9

Hive: Introduction – Architecture - Data Types - File Formats - Hive Query Language Statements – Partitions – Bucketing – Views - Sub-Query – Joins – Aggregation - Group By and Having - RCFile Implementation - Hive User Defined Function - Serialization and Deserialization - Hive Analytic Functions - Pig: Introduction - History and Anatomy – Features – Philosophy - Use Case for Pig - Pig Latin Overview - Pig Primitive Data Types - Running Pig - Execution Modes of Pig - HDFS Commands - Relational Operators - Eval Function - Complex Data Types - Piggy Bank - User-Defined Functions - Parameter Substitution - Diagnostic Operator - Word Count Example using Pig - Pig at Yahoo! - Pig Versus Hive.

UNIT IV NOSQL: MONGODB AND JASPER REPORTS 9

NoSQL Databases: Advantages - Usage - Vendors - New SQL - Comparison of SQL, NoSQL and NewSQL - MongoDB: Why Mongo DB - Terms used in RDBMS and MongoDB - Data Types - MongoDB Query Language Methods: Insert - Save - Update - Remove - Find - NULL - Count - Limit - Sort - Skip - Arrays - Aggregate - MapReduce - Cursors in MongoDB - Indexes - Import and Export - Jasper Report using Jaspersoft - Connecting to MongoDB NOSQL Database.

UNIT V FRAMEWORKS AND VISUALIZATION 9

Apache Hbase - Architecture/Storage - Features - Data Model - Shell and Implementation - Hbase Vs RDBMS - Zookeeper - Installation and Configuration - Running Zookeeper - Sqoop - Architecture - Import and Export Data – Sqoop Job - Flume - Log Collection - Working with Twitter Stream - Oozie - Simple and Complex Flow - Components - Service/Scheduler - Workflow - Apache Spark - Lambda Architecture - Spark Streaming - Spark Processing - Apache Kafka - Operations - Visualizations - Visual Data Analysis Techniques - Interaction Techniques.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Seema Acharya, Subhashini Chellappan, "Big Data and Analytics", Wiley Publications, First Edition, 2015.
2. Tom White, "Hadoop: The Definitive Guide", 3rd Edition, O'Reilly, 2012.

REFERENCES:

1. Seema Acharya, "Data Analytics using R", McGraw Hill Publications, New Edition, 2018.
2. Judith Hurwitz, Alan Nugent, Fern Halper, Marcia Kaufman, "Big data for dummies", John Wiley & Sons, Inc., 2013.
3. Donald Miner, "Map Reduce Design Patterns: Building Effective Algorithms and Analytics for Hadoop and Other Systems", O'Reilly Media, 2012.
4. Vignesh Prajapati, "Big Data Analytics with R and Hadoop", 1st Edition, Packet Publishing Limited, 2013.
5. Kyle Banker, "Mongo DB in Action", Manning Publications Company, 2012.

WEB REFERENCES:

1. <https://www.mongodb.org>
2. <https://hadoop.apache.org/>
3. <https://hive.apache.org/>
4. <https://pig.apache.org/>
5. <https://community.jaspersoft.com>

OUTCOMES:**Upon completion of the course, the students should be able to**

1. Describe the characteristics and challenges of big data analytics. (K2)
2. Apply Hadoop and MapReduce framework for processing massive volume of data. (K3)
3. Use Hive and Pig to demonstrate the structured and semi structured data. (K3)
4. Illustrate CRUD operations using MongoDB and Report generation using JasperSoft studio. (K3)
5. Explore the usage of Hadoop and its integration tools to manage Big Data and Use Visualization techniques. (K3)
6. Apply suitable frameworks and NoSQL Database to solve the real time problems. (K3)

CO- PO, PSO MAPPING:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | 2 |
| CO2 | 3 | 3 | 3 | 1 | 3 | - | - | - | - | 3 | - | - | 2 | 2 |
| CO3 | 3 | 3 | 3 | 3 | 3 | - | - | - | 2 | 3 | 1 | 2 | 3 | 2 |
| CO4 | 3 | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 3 | 2 |
| CO5 | 3 | 3 | 3 | 3 | 3 | - | - | - | - | 2 | 2 | 2 | 3 | 2 |
| CO6 | 3 | 3 | 3 | 3 | 3 | - | - | - | - | 2 | 2 | 3 | 3 | 2 |

SEMESTER - VII

| | | | | | |
|-------------------------------|---|----------|----------|----------|----------|
| 20ITPC601 SDG NO. 4 | CLOUD COMPUTING AND VIRTUALISATION | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To understand the concept of cloud computing
- To understand virtualization concepts
- To appreciate the emergence of cloud technologies and advancements
- To learn the concepts of Container Networking, Docker and Kubernetes

UNIT I INTRODUCTION**9**

Introduction to Cloud Computing – Definition of Cloud – Evolution of Cloud Computing – Underlying Principles of Parallel and Distributed Computing – Cloud Characteristics – Elasticity in Cloud – On-demand Provisioning.

UNIT II VIRTUALIZATION**9**

Basics of Virtualization – Types of Virtualization – Implementation levels of Virtualization – Load Balancing and Virtualization - Understanding Hypervisors - Virtualization Structures – Tools and Mechanisms – Full Virtualization vs Para Virtualization - Virtualization of CPU – Memory – I/O Devices –Virtual Clusters and Resource Management - Physical Vs Virtual Clusters-Live Migration-Migration of Memory, Files and Network Resources-Dynamic Deployment of virtual Clusters-Virtualization for Data Center Automation.

UNIT III CLOUD ARCHITECTURE, SERVICES AND STORAGE**9**

Layered Cloud Architecture Design – NIST Cloud Computing Reference Architecture – Public, Private and Hybrid Clouds - IaaS – PaaS – SaaS – Architectural Design Challenges – Cloud Storage – Storage-as-a-Service –

Advantages of Cloud Storage – Cloud Storage Providers – S3 - Disaster Recovery.

UNIT IV CLOUD TECHNOLOGIES AND ADVANCEMENTS

9

Hadoop– MapReduce – Virtual Box - Cloud Platforms in Industry-Google App Engine – Programming Environment for Google App Engine –Microsoft Azure – Amazon Web Services- Federation in the Cloud – Four Levels of Federation – Federated Services and Applications – Future of Federation.

UNIT V CONTAINER NETWORKING, DOCKER AND KUBERNETES

9

Motivation-The Container Networking Stack-Introduction to Container Networking-Single Host Container Networking-Modes for Docker Networking-Multi Host Networking -Multi Host Container Networking-Docker Networking- Kubernetes Networking – A Gentle Kubernetes Introduction - Overview - Intra-Pod Networking - Inter-Pod Networking - Service Discovery in Kubernetes - Ingress and Egress - Advanced Networking Topics in Kubernetes.

TOTAL: 45 PERIODS

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. Rittinghouse, John W and James F. Ransome, "Cloud Computing: Implementation, Management and Security", CRC Press, 2017.

REFERENCES:

1. Michael Hausenblas, "Container Networking From Docker to Kubernetes", O'Reilly Media, 2018.
2. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, "Mastering Cloud Computing", Tata McGraw Hill, 2013.
3. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing - A Practical Approach", Tata McGraw Hill, 2009.
4. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice) ", O'Reilly, 2009.

WEB REFERENCES:

1. https://swayam.gov.in/nd1_noc19_cs64
2. <https://www.edx.org/learn/cloud-computing>

ONLINE RESOURCES:

1. https://www.cse.iitb.ac.in/~abhirup09/Docs/cloud_computing_final_report.pdf
2. <https://www.netdevgroup.com/online/courses/virtualization/cloud-and-virtualization-concepts>

OUTCOMES:**Upon completion of the course, the student should be able to**

1. Understand key technologies, strengths and limitations of cloud computing.(K1)
2. Explore the importance of virtualization and usage of different types of virtualization(K2)
3. Recognize the core issues in cloud resource management(K1)
4. Learn different types of cloud services and cloud storage (K1)
5. Apply the various current cloud technologies (K3)
6. Interpret concepts of Container Networking, Docker and Kubernetes (K2)

CO- PO, PSO MAPPING:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| C01 | 3 | 3 | 2 | 1 | - | 2 | - | - | - | - | 3 | 1 | 3 | 1 |
| C02 | 3 | 3 | 3 | 2 | 2 | 2 | - | - | - | - | 3 | 1 | 3 | 1 |
| C03 | 2 | 3 | 2 | 2 | 3 | 2 | - | - | - | - | 3 | 1 | 3 | 1 |
| C04 | 3 | 3 | 2 | 3 | 3 | 2 | - | - | - | - | 3 | 1 | 3 | 1 |
| C05 | 3 | 3 | 2 | 3 | 3 | 2 | - | - | - | - | 1 | 1 | 1 | 1 |
| C06 | 3 | 3 | 2 | 3 | 3 | 2 | - | - | - | - | 1 | 1 | 1 | 1 |

SEMESTER - VII

| | | | | | | | | |
|-------------------------------|-----------------------------|--|--|--|----------|----------|----------|----------|
| 20CCPC701 SDG NO. 4 | MOBILE COMMUNICATION | | | | L | T | P | C |
| | | | | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- Understand the basic concepts of mobile computing
- Understand Wireless LAN, Bluetooth and WiFi Technologies
- Be familiar with the network protocol stack
- Learn the basics of mobile telecommunication system

- Be exposed to Ad-Hoc networks

UNIT I INTRODUCTION

9

Introduction to Mobile Computing — Applications of Mobile Computing-Generations of Mobile Communication Technologies-MAC Protocols — SDMA-TDMA- FDMA- CDMA

UNIT II MOBILE TELECOMMUNICATION SYSTEM

GSM — Architecture — Protocols — Connection Establishment — Frequency Allocation — Routing — Mobility Management — Security -GPRS- UMTS-Architecture

UNIT III WIRELESS NETWORKS

9

Wireless LANs and PANs — IEEE 802.11 Standard — Architecture — Services — Blue Tooth- Wi-Fi — WiMAX

UNIT IV MOBILE NETWORK LAYER

Mobile IP — DHCP — AdHoc- Proactive and Reactive Routing Protocols — Multicast Routing- Vehicular Ad Hoc networks (VANET) -MANET Vs VANET — Security

UNIT V MOBILE TRANSPORT AND APPLICATION LAYER

Mobile TCP- WAP — Architecture — WDP — WTLS — WTP -WSP — WAE — WTA Architecture — WML

TEXT BOOKS:

1. Jochen Schiller, "Mobile Communications", PHI, Second Edition, 2003.
2. Prasant Kumar Pattnaik, Rajib Mall, "Fundamentals of Mobile Computing", PHI Learning Pvt.Ltd, New Delhi - 2012

REFERENCES:

1. Dharma Prakash Agarval, Qing and An Zeng, "Introduction to Wireless and Mobile systems", Thomson Asia Pvt Ltd, 2005.
2. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, "Principles of Mobile Computing", Springer, 2003.
3. William.C.Y.Lee, "Mobile Cellular Telecommunications-Analog and Digital Systems", Second Edition, Tata Mc Graw Hill Edition, 2006.
4. C.K.Toh, "AdHoc Mobile Wireless Networks", First Edition, Pearson Education, 2002.
5. Android Developers : <http://developer.android.com/index.html>

6. Apple Developer : <https://developer.apple.com/>
7. Windows Phone Dev Center : <http://developer.windowsphone.com>
8. BlackBerry Developer : <http://developer.blackberry.com>

OUTCOMES:

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

- 1 Explain the basics of mobile telecommunication system (K2)
- 2 Illustrate the generations of telecommunication systems in wireless network (K2)
- 3 Understand the architecture of Wireless LAN technologies (K2)
- 4 Determine the functionality of network layer and Identify a routing protocol for a given Ad hoc networks (K2)
- 5 Explain the functionality of Transport and Application layer (K2)

CO - PO, PSO MAPPING:

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

SEMESTER - VII

| | | | | | |
|------------------|----------------------------------|----------|----------|----------|----------|
| 20HSMG601 | PRINCIPLES OF ENGINEERING | L | T | P | C |
| SDG NO. 4 | MANAGEMENT | 3 | 0 | 0 | 3 |

OBJECTIVES:

- 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 MANAGEMENT AND ORGANIZATIONS 9

Management – Science or Art – Manager Vs Entrepreneur – types of managers – Engineers as Managers. 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 issues and future trends in Management; Industry 4.0 – Engineering management in modern business.

UNIT II PLANNING 9

Planning, Technology Planning - Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – MBO – process - Principles and functions of engineering management – Planning Tools and Techniques – Decision making steps and process.

UNIT III ORGANISING 9

Nature and purpose – Formal and informal organization – organization chart – organization structure – types – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization – Job Design – Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management, Career planning and management.

UNIT IV DIRECTING and CONTROLLING 9

Foundations of individual and group behaviour – Motivation – theories and techniques – Leadership – Level 5 leadership - theories – Leadership as a determinant of Engineering management - Communication – process and barriers – effective communication – Communication and IT - System and process of controlling – budgetary and non-budgetary control techniques.

UNIT V INNOVATION AND TECHNOLOGY MANAGEMENT 9

Innovation management of Product and Services, Role of R & D in Entrepreneurship, Breakthrough Innovation, Disruptive Innovation – Modern approaches in Engineering management – Green management, Lean management, Managing diversity. IPR – Principles of Ethics for Engineering Managers.

TOTAL: 45 PERIODS**TEXT BOOKS:**

1. Tripathy PC and Reddy PN, Principles of Management, Tata McGraw Hill, 1999.

REFERENCES:

1. Stephen P. Robbins and Mary Coulter, Management, Prentice Hall (India) Pvt. Ltd., 10th Edition, 2009.
2. JAF Stoner, Freeman R.E and Daniel R Gilbert Management, Pearson Education, 6th Edition, 2004.
3. Stephen A. Robbins and David A. Decenzo and Mary Coulter, Fundamentals of Management Pearson Education, 7th Edition, 2011.
4. Robert Kreitner and Mamata Mohapatra, Management, Biztantra, 2008.
5. Harold Koontz and Heinz Weihrich Essentials of management Tata McGraw Hill, 1998.

WEB RESOURCES:

1. <https://www.managementstudyguide.com/organizationmanagement.htm>
2. <https://nptel.ac.in/courses/110/105/110105034/>
3. <https://courses.lumenlearning.com/boundless-management/chapter/principles-of-management/>

ONLINE RESOURCES:

1. <https://nptel.ac.in/courses/110/105/110105033/>

OUTCOMES:

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

1. Understand the evolution and basic concepts of engineering management. (K2)
2. Demonstrate the planning concepts for effective decision making process. (K2)
3. Describe the basic concepts of organization and its function. (K2)

4. Describe the ability to direct, leadership and communicate effectively. (K2)
5. Apply the concepts of innovation and technology management.(K3)

CO – PO, PSO MAPPING :

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

SEMESTER - VII

| | | | | | | | | |
|-------------------------------|--------------------------------------|--|--|--|----------|----------|----------|------------|
| 20CSPL701 SDG NO. 4 | BIG DATA ANALYTICS LABORATORY | | | | L | T | P | C |
| | | | | | 0 | 0 | 3 | 1.5 |

OBJECTIVES:

- To implement MapReduce programs for processing Big Data
- To analyze Big Data using Hive and Pig
- To realize storage of Big Data using MongoDB and Hbase
- To develop Big Data applications for streaming data using Apache Spark

LIST OF EXPERIMENTS :

1. Install, configure and run Hadoop and HDFS.
2. Implement word count / frequency programs using MapReduce.
3. Implement an MR program that processes a weather dataset.
4. Implement an application using Hive/Pig.
5. Visualize data using any plotting framework.
6. Implement an application that stores big data in Hbase / MongoDB using Hadoop/R.
7. Install, deploy and configure Apache Spark cluster. Run an application using Apache Spark.

TOTAL: 45 PERIODS

LAB REQUIREMENTS :

1. Hadoop / R
2. Hive and Pig
3. Hbase
4. MongoDB
5. Apache Spark

OUTCOMES:

On completion of this laboratory course, the students should be able to

1. Demonstrate Big Data using Hadoop framework.(K3)
2. Implement Map Reduce framework for processing big data.(K3)
3. Perform Data Analysis using Hive/Pig.(K3)
4. Use NoSQL database to Store and retrieve the data.(K3)
5. Perform Graphical Data Analysis.(K3)
6. Apply Apache Spark to build big data applications.(K3)

CO- PO, PSO MAPPING:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| C01 | 1 | 1 | 2 | - | 3 | - | - | - | - | - | - | - | 3 | 1 |
| C02 | 3 | 3 | 3 | 3 | 3 | - | - | - | - | 2 | - | 1 | 2 | 2 |
| C03 | 1 | 3 | 3 | 3 | 3 | - | - | - | - | 2 | - | 1 | 1 | 2 |
| C04 | 1 | 3 | 3 | 3 | 3 | - | - | - | - | 2 | - | 1 | 3 | 2 |
| C05 | 1 | 1 | 1 | 1 | 3 | - | - | - | - | 3 | - | 1 | 3 | 2 |
| C06 | 3 | 3 | 3 | 3 | 3 | - | - | - | - | 3 | - | 1 | 3 | 2 |

SEMESTER - VII

| | | | | | |
|--|------------------------|----------|----------|----------|----------|
| 20CCPJ 701 SDG NO: 4, 6,7,8, 9,11,12,13, 17 | PROJECT PHASE-I | L | T | P | C |
| | | 0 | 0 | 4 | 2 |

OBJECTIVES:

- Identify and describe the problem and scope of project
- Collect, analyze and present data into meaningful information using relevant tools
- Select, plan and execute a proper methodology in problem solving, work independently and ethically
- Present the results in written and oral format effectively and identify basic entrepreneurship skills in project management

GUIDELINES TO BE FOLLOWED:

The students may be grouped into 2 to 3 and work under a project supervisor and prepare a comprehensive project report after completing the work to the satisfaction of the supervisor (faculty member). 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. The Project Work Phase-I will have the following sequence:

I. Problem Identification

1. A statement of system / process specifications proposed to be developed (Block Diagram / System Architecture / Process Flow)
2. Feasibility Study
3. List of possible solutions including alternatives and constraints
4. Time Line of activities

II. A report highlighting the design finalization [based on functional requirements and standards (if any)]

III. A presentation including the following:

1. Literature survey on existing system
2. Implementation Phase (Hardware & Software)
3. Testing and Validation of the developed system

IV. Consolidated report preparation**TOTAL: 60 PERIODS****OUTCOMES:****Upon completion of the course, the students should be able to**

1. Comprehend an industrial or real life problem and identify right/ real issue with solution. (K2)
2. Analyze the necessary studies and review the literature, design a setup of equipment, complete the analysis. (K3)
3. Compose a project report based on the findings. (K6)

CO- PO, PSO MAPPING :

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

SEMESTER - VII

| | | | | | |
|--|--------------------------|----------|----------|----------|----------|
| 20CCTP701 SDG NO. 4 & 9 | SKILL ENHANCEMENT | L | T | P | C |
| | | 0 | 0 | 2 | 1 |

**APTITUDE REFRESHER & APTITUDE COMPANY SPECIFIC TRAINING
SKILLS - PHASE 1****OBJECTIVES:**

- Enhance their quantitative ability.
- Enhance their reasoning ability
- Enhance their verbal ability.

UNIT I PRODUCT COMPANY SPECIFIC TRAINING - I**10**

Product Specific Training for Amazon, Microsoft, IBM, ThoughtWorks, Juspay, Paypal, Mu Sigma, Zoho Corporation, VM Ware, Directi, Oracle, Wells Fargo, Goldman Sachs, Chargebee, Coda Global, Temenos, Freshworks, Adobe Systems.

UNIT II PRODUCT COMPANY SPECIFIC TRAINING – II 10

Product Specific Training for Ernst and Young, BA Continuum, Standard Chartered, AON Hewitt, Soliton Technologies, Payoda Technologies, Infoview Technologies, Athena Health Technology.

UNIT III SERVICE COMPANY SPECIFIC TRAINING - I 10

TCS, Wipro, TechMahindra, InfoView, RobertBosch, , NTT Data, Verizon, Payoda Technologies.

UNIT IV SERVICE COMPANY SPECIFIC TRAINING - II 10

CTS, Accenture, MindTree, MPhasis, Odessa Technologies, Vuram Technologies, Hewlett Packard, HCL.

UNIT V SERVICE COMPANY SPECIFIC TRAINING - III 5

Capgemini, Infosys, IBM, UGAM Solutions, Skava Systems, L&T Infotech, Bahwan Cybertech, Dhyam Infotech.

TOTAL : 45 PERIODS

REFERENCES:

1. Quantitative Aptitude for Competitive Exams by R. S. Agarwal
2. Quantum CAT by Sarvesh Verma
3. A Modern Approach to Logical Reasoning by R. S. Agarwal
4. Verbal Ability and Reading Comprehension by Arun sharma

**APTITUDE & TECHNICAL REFRESHER & COMPANY SPECIFIC
TRAINING AND MACHINE LEARNING - PHASE II**

OBJECTIVES:

- Enhance their quantitative ability.
- Enhance their reasoning ability
- Enhance their verbal ability.
- To understand basic of Machine Learning
- To understand methods of Machine Learning.
- To understand application of Machine Learning

UNIT I PRODUCT COMPANY SPECIFIC TRAINING – I 10

Product Specific Training for Amazon, Microsoft, IBM, ThoughtWorks, Juspay, Paypal, Mu Sigma, Zoho Corporation, VM Ware, Directi, Oracle, Wells Fargo, Goldman Sachs, Chargebee, Coda Global, Temenos, Freshworks, Adobe

Systems., Ernst and Young, BA Continuum, Standard Chartered, AON Hewitt, Soliton Technologies, Payoda Technologies, Infoview Technologies, Athena Health Technology.

UNIT II PRODUCT COMPANY SPECIFIC TRAINING – II 10

Product Specific Training for TCS,Wipro,TechMahindra, InfoView, RobertBosch, NTT Data, Verizon, Payoda Technologies. CTS, Accenture, MindTree, MPhasis, Odessa Technologies, Vuram Technologies, Hewlett Packard, HCL.

UNIT III SERVICE COMPANY SPECIFIC TRAINING - I 10

Capgemini, Infosys, IBM, UGAM Solutions, Skava Systems, L&T Infotech, Bahwan Cybertech, Dhyan Infotech.

UNIT IV INTRODUCTION TO MACHINE LEARNING 7

Overview of machine learning, real world machine learning application, Machine learning techniques- work flow of classification- importing and preprocessing data, extract features, feature selection.

UNIT V MACHINE LEARNING TECHNIQUES 8

Supervised learning- classification, regression, Unsupervised learning- clustering, association, Machine Learning (ML) Algorithms: Decision tree, SVM algorithm, Random Forest, KNN algorithm. Application of machine learning – Image Recognition, Online fraud detection.

TOTAL : 45 PERIODS

REFERENCES:

- 1 Quantitative Aptitude for Competitive Exams by R. S. Agarwal
- 2 Quantum CAT by Sarvesh Verma
- 3 A Modern Approach to Logical Reasoning by R. S. Agarwal
- 3 Verbal Ability and Reading Comprehension by Arun Sharma
- 5 Bishop, C., "Pattern Recognition and Machine Learning", Springer, 2006.
- 6 Daumé, H. III, "A Course in Machine Learning", 2015 (freely available online).

ONLINE RESOURCES

- 1 https://onlinecourses.nptel.ac.in/noc22_cs73/course
- 2 <https://www.simplilearn.com/tutorials/machine-learning-tutorial>

OUTCOMES

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

- 1 Enhance their quantitative ability. (K3)
- 2 Enhance their reasoning ability. (K3)
- 3 Enhance their verbal ability. (K3)
- 4 Understand basics of ML. (K2)
- 5 Demonstrate various methods of machine learning. (K3)
- 6 Explore various application of ML (K2)

CO - PO - PSO MAPPING:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| C01 | 2 | 3 | 3 | 2 | 3 | 2 | 2 | 1 | 3 | 2 | 1 | 2 | 3 | 2 |
| C02 | 2 | 3 | 3 | 2 | 3 | 2 | 2 | 1 | 3 | 2 | 1 | 2 | 3 | 2 |
| C03 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 1 | 2 | 2 | - | 2 | 3 | 2 |
| C04 | 2 | 2 | 1 | - | - | - | - | - | - | - | - | - | 3 | 2 |
| C05 | 3 | 2 | 2 | 1 | 1 | - | - | - | - | - | 1 | 2 | 3 | 2 |
| C06 | 3 | 3 | 3 | 2 | 1 | - | - | - | - | - | 1 | 2 | 3 | 2 |

SEMESTER - VIII

| | | | | | |
|--|-------------------------|---|---|---|---|
| 20CCPJ801 SDG NO. 4,6,7, 8, 9,11,12,13,17 | PROJECT PHASE-II | L | T | P | C |
| | | 0 | 0 | 8 | 4 |

OBJECTIVES:

- Identify and describe the problem and scope of project
- Collect, analyze and present data into meaningful information using relevant tools
- Select, plan and execute a proper methodology in problem solving, work independently and ethically
- Present the results in written and oral format effectively and identify basic entrepreneurship skills in project management

GUIDELINES TO BE FOLLOWED:

The students may be grouped into 2 to 3 and work under a project supervisor and prepare a comprehensive project report after completing the work to the satisfaction of the supervisor (faculty member). 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. The Project Work Phase-II will have the following Sequence:

I. Problem Identification

1. List of possible solutions including alternatives and constraints
2. Cost benefit analysis
3. Time Line of activities

II. A report highlighting the design finalization [based on functional, non-functional requirements and standards (if any)]

III. A presentation including the following:

1. Implementation Phase (Hardware & Software)
2. Testing and Validation of the developed system
3. Learning in the Project and Future Enhancement

IV. Consolidated report preparation**TOTAL: 60 PERIODS****OUTCOMES :****Upon completion of the course, the students should be able to**

1. Comprehend an industrial or real life problem and identify right/ real issue with solution. (K2)
2. Analyze the necessary studies and review the literature, design a setup of equipment, complete the analysis. (K3)
3. Compose a project report based on the findings. (K6)

CO- PO, PSO MAPPING :

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

PROFESSIONAL ELECTIVE I

| | | | | | |
|--------------------------------------|-----------------------------|----------|----------|----------|----------|
| 20CSPC501 SDG NO. 9 | INTERNET PROGRAMMING | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- Understand different Internet Technologies
- Be exposed to Java specific Web services architecture
- Create Dynamic Web Pages using different Scripting
- Build tools that assist in automating data transfer over the Internet.

UNIT I WEBSITE BASICS, HTML 5, CSS 3, WEB 2.0 9

Web Essentials: Clients, Servers And Communication –World Wide Web – HTML5 – Tables – Lists – Image – HTML5 Control Elements – Semantic Elements – Drag And Drop – Audio – Video Controls – CSS3 – Inline, Embedded and External Style Sheets – Rule Cascading – Inheritance – Backgrounds – Border Images – Colors – Shadows – Text – Transformations – Transitions – Animations.

UNIT II CLIENT SIDE PROGRAMMING 9

Java Script: An Introduction to Javascript–Javascript DOM Model–Date and Objects,- Regular Expressions- Exception Handling-Validation-Built-In Objects-Event Handling- DHTML with Javascript- JSON Introduction – Syntax– Function Files – HTTP Request – SQL.

UNIT III SERVERSIDE PROGRAMMING 9

Servlets: Java Servlet Architecture - Servlet Life Cycle- Form GET and POST actions- Session Handling- Understanding Cookies- DATABASE CONNECTIVITY: JDBC perspectives, JDBC program example - JSP: Understanding Java Server Pages-JSP Standard Tag Library (JSTL)-Creating HTML forms by embedding JSP code.

UNIT IV PHP 9

An introduction to PHP: PHP- Using PHP- Variables- Program control- Built-in functions- Form Validation- Regular Expressions - File handling – Cookies - Connecting to Database.

UNIT V XML and INTRODUCTION TO AJAX**9**

XML: Basic XML- Document Type Definition- XML Schema DOM and Presenting XML, XML Parsers and Validation, XSL and XSLT Transformation. AJAX: Ajax Client Server Architecture-XML HTTP Request Object-Call Back Methods.

TOTAL: 45 PERIODS**TEXT BOOKS:**

1. Deitel and Deitel and Nieto, "Internet and World Wide Web- How to Program", Prentice Hall India Learning Pvt.Ltd, Fifth Edition, 2011.
2. Elliotte Rusty Harold, "Java Network Programming", O'Reilly Publishers, 2013.

REFERENCES:

1. Stephen Wynkoop and John Burke, "Running a Perfect Website", QUE, 2nd Edition, 1999.
2. Chris Bates, Web Programming – "Building Intranet Applications", 3rd Edition, Wiley Publications, 2009.
3. Jeffrey C and Jackson, – "Web Technologies A Computer Science Perspective", Pearson Education, 2011.
4. Gopalan N.P. and Akilandeswari J., "Web Technology", Prentice Hall of India, 2011.
5. Uttam K.Roy, "Web Technologies", Oxford University Press, 2011.

WEB REFERENCES:

1. https://www.brainkart.com/subject/Internet-Programming_173/
2. <https://nptel.ac.in/courses/106105084/>

ONLINE RESOURCES:

1. <https://www.udemy.com/course/the-web-developer-bootcamp/>
2. <https://www.coursera.org/specializations/web-design>

OUTCOMES:

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

1. Construct a basic website using HTML and Cascading Style Sheets. (K2)
2. Build dynamic web pages with validation using Javascript objects and by applying different event handling mechanisms. (K3)
3. Develop server side programs using Servlets and JSP. (K2)
4. Construct simple web pages in PHP. (K3)
5. Represent web data using XML and develop dynamic web page using AJAX. (K2)
6. Use web services to develop interactive web applications (K3)

CO- PO, PSO MAPPING:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| C01 | 1 | 1 | - | 1 | - | - | - | - | 1 | - | - | 2 | - | 2 |
| C02 | 1 | 3 | 3 | 3 | 2 | - | - | - | 2 | 1 | - | 2 | 2 | 2 |
| C03 | 1 | 3 | - | 2 | 2 | - | - | - | 1 | - | - | - | 1 | 2 |
| C04 | 1 | 3 | - | - | 2 | - | - | - | 1 | 2 | - | - | - | 2 |
| C05 | 1 | 1 | - | - | 1 | - | - | - | 1 | - | - | - | | 2 |
| C06 | - | 3 | 2 | 1 | 2 | - | - | - | 2 | 1 | - | - | 1 | 2 |

PROFESSIONAL ELECTIVE I

| | | | | | |
|--------------------------------------|---|----------|----------|----------|----------|
| 20CSEL501 SDG NO. 9 | DATA WAREHOUSING AND DATA MINING | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To understand Data Warehouse concepts, Architecture, Business Analysis and Tools
- To understand Data Preprocessing and Data Visualization techniques
- To study algorithms for finding Hidden and Interesting patterns in Data
- To understand and apply various Classification and Clustering techniques

UNIT I DATA WAREHOUSING, BUSINESS ANALYSIS AND ON-LINE ANALYTICAL PROCESSING**9**

Basic Concepts – Data Warehousing Components – Building a Data Warehouse – Database Architectures for Parallel Processing – Parallel DBMS Vendors – Multidimensional Data Model – Data Warehouse Schemas for Decision Support - Concept Hierarchies - Characteristics of OLAP Systems – Typical OLAP Operations - OLAP and OLTP.

UNIT II INTRODUCTION TO DATA MINING**9**

Introduction to Data Mining Systems – Knowledge Discovery Process – Data Mining Techniques – Issues – Applications- Data Objects and Attribute Types - Statistical Description of Data - Data Preprocessing – Cleaning - Integration - Reduction - Transformation and Discretization - Data Visualization - Data Similarity and Dissimilarity Measures.

UNIT III FREQUENT PATTERN ANALYSIS**9**

Mining Frequent Patterns - Associations and Correlations – Mining Methods- Pattern Evaluation Method – Pattern Mining in Multilevel - Multi Dimensional Space – Constraint Based Frequent Pattern Mining - Classification Using Frequent Patterns.

UNIT IV CLASSIFICATION AND CLUSTERING**9**

Decision Tree Induction – Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines – Lazy Learners – Model Evaluation and Selection - Techniques to improve Classification Accuracy - Clustering Techniques – Cluster Analysis - Partitioning Methods – Hierarchical Methods – Density Based Methods – Grid Based Methods – Evaluation of Clustering – Clustering High Dimensional Data - Clustering with Constraints - Outlier Analysis - Outlier Detection Methods.

UNIT V DATA ANALYSIS TOOL**9**

Datasets – Introduction, Iris plants database, Breast cancer database, Auto Imports Database - Introduction to WEKA - Explorer – Getting started, Exploring the Explorer - Learning algorithms - Clustering algorithms - Association–Rule Learners.

TOTAL: 45 PERIODS**TEXT BOOKS:**

1. Jiawei Han and Micheline Kamber, “Data Mining Concepts and Techniques”, Third Edition, Elsevier, 2012.
2. Alex Berson and Stephen J. Smith, “Data Warehousing, Data Mining & OLAP”, Tata McGraw – Hill Edition, 35th Reprint 2016.

REFERENCES:

1. K.P. Soman, Shyam Diwakar and V. Ajay, “Insight into Data Mining Theory and Practice”, Eastern Economy Edition, Prentice Hall of India, 2006.
2. Ian H. Witten and Eibe Frank, “Data Mining: Practical Machine Learning Tools and Techniques”, Elsevier, Second Edition, 2005.
3. Parteek Bhatia, “Data Mining and Data Warehousing: Principles and Practical Techniques”, Cambridge University Press, 2019.
4. Pranjali Deshpande, Soudamini Patil, “Data Warehousing and Data Mining”, First Edition, Technical Publications, 2020.
5. Dr. B. Shadaksharappa, Mr. P. Ramkumar, Dr. T.N. Prabakar, “Data Warehousing and Data Mining”, First Edition, Book Rivers, 2022.

WEB REFERENCES:

1. <https://nptel.ac.in/courses/106/105/106105174/00>
2. https://swayam.gov.in/nd1_noc20_cs12/preview
3. <https://freevideolectures.com/course/3609/data-warehousing>

ONLINE RESOURCES:

1. https://www.tutorialspoint.com/data_mining/index.htm
2. <https://www.guru99.com/online-analytical-processing.html>
3. <https://www.cs.waikato.ac.nz/ml/weka/courses.html>
4. https://www.tutorialspoint.com/weka/what_is_weka.htm

OUTCOMES:**Upon completion of the course, the student should be able to**

1. Use a Data Warehouse system and perform Business Analysis with OLAP Tools. (K3)
2. Recognize and identify suitable Pre-processing and Visualization techniques for Data Analysis. (K1)
3. Apply frequent Pattern and Association Rule Mining techniques for Data Analysis. (K3)
4. Apply appropriate Classification techniques for Data Analysis. (K3)
5. Apply appropriate Clustering techniques for Data Analysis. (K3)
6. Use WEKA tools for feature selection, classification and clustering for real time data. (K3)

CO- PO, PSO MAPPING :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| C01 | 2 | 3 | 3 | 2 | 2 | 1 | 1 | - | 2 | 2 | 2 | 2 | 3 | 3 |
| C02 | 3 | 3 | 3 | 2 | 2 | 2 | 1 | - | 2 | 2 | 2 | 3 | 3 | 2 |
| C03 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | - | 2 | 2 | 2 | 3 | 3 | 3 |
| C04 | 3 | 3 | 3 | 3 | 2 | 2 | 1 | - | 2 | 3 | 3 | 3 | 2 | 2 |
| C05 | 3 | 2 | 3 | 2 | 3 | 2 | 2 | - | 2 | 2 | 2 | 3 | 2 | 3 |
| C06 | 3 | 2 | 3 | 2 | 3 | 2 | 2 | - | 2 | 2 | 2 | 3 | 2 | 3 |

PROFESSIONAL ELECTIVE I

| | | | | | |
|--------------------------|----------------------------|---|---|---|---|
| 20CCEL501 SDG NO. 4,9 | EMBEDDED REAL TIME SYSTEMS | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To understand the concepts of embedded system design and analysis.
- To learn the architecture and programming of ARM processor
- To get exposed to the basic concepts of embedded programming
- To learn the real time operating systems
- To understand processes and performance of operating systems

UNIT I INTRODUCTION TO EMBEDDED SYSTEM DESIGN 9

Complex systems and micro processors– Embedded system design process –Design example: Model train controller- Design methodologies- Design flows - Requirement Analysis – Specifications-System analysis and architecture design – Quality Assurance techniques - Designing with computing platforms – consumer electronics architecture – platform-level performance analysis.

UNIT II ARM PROCESSOR AND PERIPHERALS 9

ARM Architecture Versions – ARM Architecture – Instruction Set – Stacks and Subroutines – Features of the LPC 214X Family – Peripherals – The Timer Unit – Pulse Width Modulation Unit – UART – Block Diagram of ARM9 and ARM Cortex M3MCU.

UNIT III EMBEDDED PROGRAMMING 9

Components for embedded programs- Models of programs- Assembly, linking and loading – compilation techniques- Program level performance analysis – Software performance optimization–Program level energy and power analysis and optimization–Analysis and optimization of program size-Program validation and testing.

UNIT IV REAL TIME SYSTEMS 9

Structure of a Real Time System – Real time communication-Network topology protocol - Estimating program run times – Task assignment and scheduling –Fault Tolerance Techniques – Reality, Evaluation – Clock synchronization.

UNIT V PROCESSES AND OPERATING SYSTEMS 9

Introduction – Multiple tasks and multiple processes – Multirate systems-Preemptive real- time operating systems- Priority based scheduling-

Interprocess communication mechanisms - Evaluating operating system performance- power optimization strategies for processes - Example Real time operating systems-POSIX-Windows CE. - Distributed embedded systems - MPSoCs and shared memory multiprocessors. – Design Example - Audio player, Engine control unit – Video accelerator.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Marilyn Wolf, “Computers as Components - Principles of Embedded Computing System Design”, 3rd Edition, Morgan Kaufmann Publisher (An imprint from Elsevier), 2012. (UNIT I, II, III, V)
2. Jane W.S.Liu, “Real Time Systems”, Pearson Education, Third Indian Reprint, 2003.(UNIT IV)

REFERENCES:

1. Lyla B.Das, “Embedded Systems: An Integrated Approach”, Pearson Education, 2013
2. Jonathan W.Valvano, “Embedded Microcomputer Systems Real Time Interfacing”, 3rd Edition, Cengage Learning, 2012.
3. Arnold.S.berger, “Embedded System Design: An Introduction to processes Tools, & Techniques”, CRC Press, 2017
4. David. E. Simon, “An Embedded Software Primer”, 1st Edition, Fifth Impression, Addison Wesley Professional, 2007.
5. Raymond J.A. Buhr, Donald L.Bailey, “An Introduction to Real-Time Systems- From Design to Networking with C/C++”, Prentice Hall, 1999.
6. C.M.Krishna, Kang G.Shin, “Real-Time Systems”, International Editions, McGraw Hill, 1997
7. K.V.K.K.Prasad, “Embedded Real-Time Systems: Concepts, Design & Programming”, Dream Tech Press, 2005.
8. Sriram V Iyer, Pankaj Gupta, “Embedded Real Time Systems Programming”, Tata McGraw Hill, 2004.

WEB REFERENCES:

1. <https://developer.arm.com/ip-products/processors/classic-processors>
2. <https://spin.atomicobject.com/2015/08/19/learn-embedded-systems-programming/>
3. <http://www.ocfreaks.com/tag/lpc2148/>
4. <https://www.freertos.org/about-RTOS.html>

ONLINE RESOURCES:

1. https://swayam.gov.in/nd1_noc20_cs15/preview
2. https://swayam.gov.in/nd1_noc20_cs16/preview

OUTCOMES:

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

- 1 Describe the architecture of ARM processor(K2)
- 2 Understand the programming of the ARM processor(K2).
- 3 Outline the concepts of embedded systems(K1)
- 4 Analyze and validate the program (K3)
- 5 Explain the basic concepts of real time operating system design(K2)
- 6 Model real-time applications using embedded-system concepts(K3)

CO- PO, PSO MAPPING :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | 3 | 1 | 3 |
| CO2 | 3 | 3 | 2 | - | - | - | - | - | - | - | - | 3 | 1 | 3 |
| CO3 | 3 | 2 | 1 | - | - | - | - | - | - | - | - | 2 | 1 | 3 |
| CO4 | 2 | 2 | 3 | - | - | - | - | - | - | - | - | - | 3 | 3 |
| CO5 | 3 | 3 | - | - | - | - | - | - | - | - | - | - | 1 | 3 |
| CO6 | 2 | 2 | 1 | - | - | - | - | - | - | - | - | - | 1 | 3 |

PROFESSIONAL ELECTIVE I

| | | | | | |
|-------------------------------------|------------------------------------|----------|----------|----------|----------|
| 20CCE504 SDG NO. 4 | SYSTEM ON CHIP ARCHITECTURE | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- This course introduces computer system design with emphasis on fundamental ideas, analytical techniques that are applicable to a range of applications & architectures, hardware and software programmability verses performance, entire memory organization, starch pads, cache memories and objective in cache data how to deal the write polices

UNIT I INTRODUCTION TO THE SYSTEM APPROACH**9**

System Architecture, Components of the system, Hardware & Software, Processor Architectures, Memory and Addressing. System level interconnection, An approach for SOC Design, System Architecture and Complexity.

UNIT II PROCESSORS**9**

Introduction , Processor Selection for SOC, Basic concepts in Processor Architecture, Basic concepts in Processor Micro Architecture, Basic elements in Instruction handling. Buffers: minimizing Pipeline Delays, Branches, More Robust Processors, Vector Processors and Vector Instructions extensions, VLIW Processors, Superscalar Processors.

UNIT III MEMORY DESIGN FOR SOC**9**

A: Overview of SOC external memory, Internal Memory, Size, Scratchpads and Cache memory, Cache Organization, Cache data, Write Policies, Strategies for line replacement at miss time,

B: Types of Cache, Split – I, and D – Caches, Multilevel Caches, Virtual to real translation, SOC Memory System, Models of Simple Processor – memory interaction.

UNIT IV: Interconnects Customization and Configuration**9**

Inter Connect Architectures, Bus: Basic Architectures, SOC Standard Buses, Analytic Bus Models, Using the Bus model, Effects of Bus transactions and contention time. SOC Customization: An overview, Customizing Instruction Processor, Reconfiguration Technologies, Mapping design onto Reconfigurable devices, Instance- Specific design, Customizable Soft Processor, Reconfiguration - overhead analysis and trade-off analysis on reconfigurable Parallelism.

UNIT V: Application Studies / Case Studies**9**

SOC Design approach, AES algorithms, Design and Evaluation, Image compression – JPEG compression.

TOTAL : 45 PERIODS**TEXT BOOKS:**

1. Michael J. Flynn and Wayne Luk, “Computer System Design System on Chip”, Wiley India Pvt. Ltd., 2012.

REFERENCE BOOKS:

1. Steve Furber, “ARM System on Chip Architecture”, Addison Wesley Professional, 2nd Edition, 2000.
2. Ricardo Reis, “Design of System on a Chip: Devices and Components”, Springer, 1st Edition, 2004.

E-RESOURCES:

1. <https://ieeexplore.ieee.org/document/1652898/>
2. <https://ieeexplore.ieee.org/document/5196691>

3. <https://dl.acm.org/citation.cfm?id=557024>
4. <https://nptel.ac.in/courses/108102045/10>
5. <https://freevidelectures.com/course/2341/embedded-systems/10>

OUTCOMES:

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

1. Understand the basics of System on Chip and Platform based design.(K2)
2. Understand about SoC Design Methodology, hardware and software programmability versus performance.(K2)
3. Know about entire memory organization, starch pads, cache memories and objective in cache data how to deal with the write policies (K1)
4. Know how the system forms with the lot of component and has majority about system level interconnections.(K2)
5. Describe examples of applications and systems developed using a co-design approach.(K2)
6. Investigate new techniques for future systems. (K3)

CO- PO, PSO MAPPING :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| C01 | 2 | 3 | 2 | 2 | 2 | 1 | - | 1 | - | 2 | - | 1 | 2 | 3 |
| C02 | 1 | 3 | 1 | - | - | - | 2 | 3 | - | 1 | 2 | - | 2 | 3 |
| C03 | - | 2 | 3 | 3 | 2 | 2 | - | - | 3 | - | - | 2 | 2 | - |
| C04 | 1 | 3 | - | - | 1 | | 3 | - | 1 | 2 | 3 | - | 1 | 3 |
| C05 | 2 | - | 2 | - | - | 2 | - | 2 | - | 2 | - | 3 | 3 | - |

PROFESSIONAL ELECTIVE I

| | | | | | |
|---------------------------|--|---|---|---|---|
| 20MGEI703 SDG NO. 9,12 | FOUNDATION SKILLS IN INTEGRATED PRODUCT DEVELOPMENT | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To understand the global trends and development methodologies of various types of products and services.
- To conceptualize, prototype and develop product management plan for a new product based on the type of the new product and development methodology integrating the hardware, software, controls, electronics and mechanical systems.

- To understand requirement engineering and know how to collect, analyze and arrive at requirements for new product development and convert them in to design specification.
- To understand system modeling for system, sub-system and their interfaces and arrive at the optimum system specification and characteristics.
- To develop documentation, test specifications and coordinate with various teams to validate and sustain up to the EoL (End of Life) support activities for engineering customer.

UNIT I FUNDAMENTALS OF PRODUCT DEVELOPMENT 9

Global Trends Analysis and Product decision - Social Trends - Technical Trends- Economical Trends - Environmental Trends - Political/Policy Trends - Introduction to Product Development Methodologies and Management - Overview of Products and Services - Types of Product Development - Overview of Product Development methodologies - Product Life Cycle – Product Development Planning and Management.

UNIT II REQUIREMENTS AND SYSTEM DESIGN 9

Requirement Engineering - Types of Requirements - Requirement Engineering - traceability Matrix and Analysis - Requirement Management - System Design & Modeling - Introduction to System Modeling - System Optimization - System Specification - Sub-System Design - Interface Design.

UNIT III DESIGN AND TESTING 9

Conceptualization - Industrial Design and User Interface Design - Introduction to Concept generation Techniques – Challenges in Integration of Engineering Disciplines - Concept Screening & Evaluation - Detailed Design - Component Design and Verification – Mechanical, Electronics and Software Subsystems - High Level Design/Low Level Design of S/W Program - Types of Prototypes, S/W Testing- Hardware Schematic, Component design, Layout and Hardware Testing – Prototyping - Introduction to Rapid Prototyping and Rapid Manufacturing - System Integration, Testing, Certification and Documentation

UNIT IV SUSTENANCE ENGINEERING AND END-OF-LIFE (EOL) SUPPORT 9

Introduction to Product verification processes and stages - Introduction to Product Validation processes and stages - Product Testing Standards and Certification - Product Documentation - Sustenance -Maintenance and Repair – Enhancements - Product EoL - Obsolescence Management – Configuration Management - EoL Disposal.

UNIT V BUSINESS DYNAMICS – ENGINEERING SERVICES INDUSTRY 9

The Industry - Engineering Services Industry - Product Development in Industry versus Academia –The IPD Essentials - Introduction to Vertical Specific Product Development processes -Manufacturing/Purchase and Assembly of Systems - Integration of Mechanical, Embedded and Software Systems – Product Development Trade-offs - Intellectual Property Rights and Confidentiality – Security and Configuration Management.

TOTAL: 45 PERIODS**TEXT BOOK:**

1. Book specially prepared by NASSCOM as per the MoU.
2. Karl T Ulrich and Stephen D Eppinger, "Product Design and Development", Tata McGraw Hill, 5th Edition, 2011.
3. John W Newstorm and Keith Davis, "Organizational Behavior", Tata McGraw Hill, 11th Edition, 2005.

REFERENCES :

1. Hiriappa B, "Corporate Strategy – Managing the Business", Author House, 2013.
2. Peter F Drucker, "People and Performance", Butterworth – Heinemann [Elsevier], Oxford, 2004.
3. Vinod Kumar Garg and Venkita Krishnan N K, "Enterprise Resource Planning – Concepts", 2nd Edition, Prentice Hall, 2003.
4. Mark S Sanders and Ernest J McCormick, "Human Factors in Engineering and Design", McGraw Hill Education, 7th Edition, 2013.

WEB REFERENCES:

1. <https://www.udemy.com/course/strategic-product-management-and-leadership/>
2. <https://www.udemy.com/course/building-insanely-great-products/>
3. <https://www.coursera.org/learn/customer-insights-orientation>

ONLINE RESOURCES:

1. https://pursuite-production.s3-ap-southeast-1.amazonaws.com/media/cms_page_media/162/FSIPD+OBF+-+2012+F0_1.pdf
2. <https://futureskillsnasscom.edcast.com/pathways/product-management-primer-pathway/cards/5603673#>

OUTCOMES:

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

1. Explain the basic essentials of product development. (K2)
2. Discuss the learnings to incorporate effective design for product development. (K2)
3. Describe the various tools of innovation & product development process in the Business context. (K2)
4. Identify the various process and choose the appropriate tools for designing, development and testing. (K2)
5. Discuss disruptive models / process to manage a product development from start to finish. (K2)

CO-PO, PSO MAPPING:

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

PROFESSIONAL ELECTIVE I

| | | | | | | | | |
|--|----------------------------|--|--|--|----------|----------|----------|----------|
| 20CSEL607 SDG NO., 9,16 | AGILE METHODOLOGIES | | | | L | T | P | C |
| | | | | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To 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
- To provide a good understanding of software design and a set of software technologies and APIs
- To do a detailed examination and demonstration of Agile development and testing techniques
- To understand Agile development and testing

UNIT I 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 II AGILE PROCESSES

9

Lean Production – SCRUM, Crystal - Feature Driven Development - Adaptive Software Development – Extreme Programming - Method Overview – Lifecycle – Work Products - Roles and Practices.

UNIT III 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 IV AGILITY AND REQUIREMENTS ENGINEERING

9

Impact of Agile Processes in RE–Current Agile Practices – Variance – Overview of RE Using Agile – Managing Unstable Requirements – Requirements Elicitation – Agile Requirements Abstraction Model – Requirements Management in Agile Environment - Agile Requirements Prioritization – Agile Requirements Modeling and Generation – Concurrency in Agile Requirements Generation.

UNIT V AGILITY AND QUALITY ASSURANCE

9

Agile Product Development – Agile Metrics – Feature Driven Development (FDD) – Financial and Production Metrics in FDD – Agile Approach to Quality Assurance – Test Driven Development – Agile Approach in Global Software Development.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. David J. Anderson and Eli Schragenheim, “Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results”, Prentice Hall, 2003.
2. Hazza and Dubinsky, “Agile Software Engineering, Series: Undergraduate Topics in Computer Science”, Springer, 2009.

REFERENCES:

1. Craig Larman, “Agile and Iterative Development: A Manager's Guide”, Addison-Wesley, 2004.

2. Kevin C. Desouza, "Agile Information Systems: Conceptualization, Construction, and Management", Butterworth-Heinemann, 2007.
3. Jorgen Hesselberg, "Unlocking Agility: An Insider's Guide to Agile Enterprise Transformation", Addison - Wesley Signature Series, First Edition, 2018.
4. Mike Cohn, "Agile Estimating & Planning", Pearson Education India, First Edition, 2006.
5. Roman Pichler, "Agile Product Management with Scrum", Pearson Education India, 2011

WEB REFERENCES:

1. http://www.umsl.edu/~sauterv/analysis/6840_f09_papers/Nat/Agile.html
2. <https://www.classcentral.com/help/section/edx>
3. <https://nptel.ac.in/courses/110/104/110104073/>
4. <https://www.coursera.org/learn/software-processes-and-agile-practices>

ONLINE RESOURCES:

1. <https://www.udacity.com/course/software-development-process--ud805>
2. <https://www.edx.org/course/agile-software-development>

OUTCOMES:**Upon completion of the course, the students should be able to**

1. Realize the importance of interacting with business stakeholders in determining the requirements for a software system.(K3)
2. Perform iterative software development processes.(K2)
3. Point out the impact of social aspects on software development success.(K2)
4. Develop techniques and tools for improving team collaboration and software quality.(K3)
5. Perform Software process improvement as an ongoing task for development teams.(K3)
6. Show how agile approaches can be scaled up to the enterprise level.(K2)

CO- PO, PSO MAPPING :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 3 | 2 | 2 | 1 | - | 1 | 1 | - | - | - | 1 | 2 | 2 |
| CO2 | 2 | 2 | 1 | 2 | 2 | - | 3 | 1 | - | - | - | 1 | 2 | 2 |
| CO3 | 2 | 2 | 3 | 2 | 2 | 1 | 1 | 2 | - | - | - | 1 | 2 | 3 |
| CO4 | 1 | 1 | 3 | 2 | 2 | - | 1 | 1 | - | - | 1 | 1 | 2 | 2 |
| CO5 | 3 | 3 | 1 | 2 | 2 | - | 1 | 1 | - | - | - | 1 | 2 | 2 |
| CO6 | 3 | 2 | 2 | 1 | - | - | - | 1 | 1 | 2 | - | 1 | 2 | 2 |

PROFESSIONAL ELECTIVE I

| | | | | | |
|-------------------------------------|----------------------------------|----------|----------|----------|----------|
| 20CCEL507 SDG NO.4 | COMPUTATIONAL LINGUISTICS | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To learn the fundamentals required for computational Linguistics
- To understand the speech recognition and various Linguistic models
- To understand the concept of Syntactic Analysis
- To understand the role of semantics and pragmatics
- To understand the discourse analysis and applications of Computational Linguistics

UNIT I INTRODUCTION**9**

Computers in Linguistics-Issues-Motivation-Theory of Language-Features of Indian Language-Issues in Font-Coding Techniques -Language modeling:- Grammar - based LM- Statistical LM-Regular expressions, Finite State Automata - English Morphology, Transducers for lexicon and rules, Tokenization - Detecting and Correcting spelling Errors, Minimum edit

UNIT II SPEECH AND PROBABILISTIC MODELS**9**

Speech-Phonetics-Speech Synthesis-Automatic Speech Recognition-Speech Recognition:-Advanced topics-Computational Phonology- Weighted Automata- N-grams,Evaluating N-grams- Corpus Analysis-Smoothing-Entropy-Part-of-Speech-Taggers-Issues in PoS tagging-Rule based- Hidden Markov models.

UNIT III SYNTACTIC ANALYSIS**9**

Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for Grammar-Dependency Grammar-Syntactic Parsing, Ambiguity, Dynamic Programming Parsing-Shallow Parsing-Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs-Feature structures, Unification of feature Structures.

UNIT IV SEMANTICS AND PRAMATICS**9**

Requirements for representation, First-order Logic, Description Logics-Syntax-Driven Semantic analysis, Semantic attachments-Word Senses, Relations between Senses, Thematic Roles, Selection algorithm restrictions-Word Sense Disambiguation, WSD using Supervised, Dictionary and Thesaurus and Distributional methods.

UNIT V DISCOURSE ANALYSIS, LEXICAL RESOURCES AND APPLICATION**9**

Discourse Segmentation, Coherence-Reference Phenomena, Anaphora Resolution using Hobbs and Centring Algorithm-Coreference Resolution-Resources: Porter Stemmer, Lemmatizer, Penn Treebanks, Brill's Tagged, WordNet, PropBank, FrameNet, Brown Corpus- Information Extraction-Question Answering and Summarization-Dialogue and Conversational Agents

TOTAL: 45 PERIODS**TEXT BOOKS:**

1. Daniel Jurafsky, James H. Martin- "Speech and Language processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech", Pearson Publication, 2014.
2. Ronald Hausser "Foundations of Computational Linguistics", Springer-Verlag, 1999.
3. Steven Bird, Ewan Klein and Edward Loper "Natural Language Processing with Python", First Edition, O'Reilly Media, 2009.

REFERENCES:

1. Breckenridge Baldwin "Language Processing with Java and Lingpipe Cookbook", Atlantic Publisher, 2015.
2. Richard M Reese "Natural Language Processing with Java, O'Reilly Media, 2015.
3. Nitin Indurkha and Fred J. Damerau, "Handbook of Natural Language Processing", Second Edition, Chapman and Hall/CRC Press, 2010.

4. Tanveer Siddiqui, U.S. Tiwary “ Natural Language Processing and Information Retrieval”, Oxford University.

WEB REFERENCES:

1. <http://www.cse.iitb.ac.in/~cs626-449>
2. <https://web.stanford.edu/jurafsky/slp3/>
3. <http://www.linguisticsociety.org/files/languagebegin.pdf>

ONLINE RESOURCES:

1. www.nlp.stanford.edu

OUTCOMES:

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

- 1 Tag a given text with basic Language features. (K2)
- 2 Design an innovative application. (K3)
- 3 Illustrate Speech and Probabilistic Models (K2)
- 4 Implement a rule based system to tackle syntax of a Language. (K3)
- 5 Design a tag set to be used for statistical processing for real-time applications. (K3)
- 6 Compare and contrast the use of different statistical approaches for different types of applications. (K3)

CO- PO, PSO MAPPING :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| C01 | 3 | 1 | 2 | 2 | 2 | 2 | 1 | 2 | 1 | 1 | 2 | 2 | 3 | 3 |
| C02 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 |
| C03 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 |
| C04 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 |
| C05 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 3 |
| C06 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 3 |

PROFESSIONAL ELECTIVE I

| | | | | | |
|-------------------------|----------------------|---|---|---|---|
| 20CCEL508 SDG NO.4,9 | DISTRIBUTED DATABASE | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To learn the principal and foundation of distributed database.
- To learn the architecture, design issue and integrity control of distributed database.
- To learn the details of query processing and query optimization technique.
- To learn the concept of transaction management in distributed database.

UNIT I INTRODUCTORY CONCEPTS AND DESIGN OF (DDBMS) 9

Data Fragmentation; Replication; and allocation techniques for DDBMS; Methods for designing and implementing DDBMS, designing a distributed relational database; Architectures for DDBMS: cluster federated, parallel databases and client server architecture.

UNIT II QUERY PROCESSING 9

Overview of Query Processing: Query processing problem; Objectives of Query Processing; Complexity of Relational Algebra operations; characterization of Query processors; Layers of Query Processing; Translation of global queries.

UNIT III TRANSACTION MANAGEMENT 9

Introduction To Transaction Management: Definition of Transaction, Properties of Transaction, types of transaction ; Distributed Concurrency Control: Serializability theory; Taxonomy of concurrency control mechanisms; locking bases concurrency control algorithms.

UNIT IV DISTRIBUTED OBJECT DATABASE MANAGEMENT SYSTEMS 9

Fundamental Object concepts and Object models; Object distribution design; Architectural issues; Object management; Distributed object storage; Object query processing.

UNIT V CURRENT TRENDS & DEVELOPMENTS RELATED TO DISTRIBUTED DATABASE APPLICATIONS TECHNOLOGIES 9

Distributed Object/component-based DBMS; Database Interoperability including CORBA; DCOM and Java RMI; Distributed document-based systems; XML and Workflow management.

TEXT BOOKS:

1. Distributed Databases - Principles and Systems; Stefano Ceri; Guiseppe Pelagatti; Tata McGraw Hill; 1985.
2. Fundamental of Database Systems; Elmasri & Navathe; Pearson Education; Asia

REFERENCE BOOKS:

1. Database System Concepts; Korth & Sudarshan; TMH
2. Principles of Distributed Database Systems; M. Tamer Özsu; and Patrick Valduriez Prentice Hall

OUTCOMES**On completion of the course students will be able to**

1. Understand and describe internal algorithms in detail. (K2)
- 2 Identify and be able to use recent and advanced database techniques (K2)
- 3 Decide on configuration issues related to database operation and performance. (K2)
- 4 Summarize the concepts of Transaction Management (K3)
- 5 Analyze and optimize transactional code, identifying causes of possible anomalies and correct them. (K3)
- 6 Decide on optimization issues given a known database workload, by manipulating indexes, choosing more adequate data types, and modifying queries.(K3)

CO- PO, PSO MAPPING :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| C01 | - | 2 | 2 | 3 | 1 | - | - | - | 2 | 2 | 3 | 2 | 3 | 2 |
| C02 | 1 | 2 | 3 | 2 | | - | - | - | - | - | 2 | 2 | 2 | 2 |
| C03 | 2 | 3 | 2 | 2 | 1 | - | - | - | - | - | - | 1 | 2 | 1 |
| C04 | 2 | 3 | 2 | 2 | 2 | - | - | - | - | - | - | 1 | 2 | 2 |
| C05 | 2 | 3 | 2 | 2 | 2 | - | - | - | - | - | 2 | 2 | 2 | 2 |
| C06 | 2 | 3 | 2 | 2 | 2 | - | - | - | - | - | 2 | 2 | 2 | 2 |

PROFESSIONAL ELECTIVE I

| | | | | | |
|-----------------------|--------------------------|---|---|---|---|
| 20ECEL709 SDG NO.7 | DIGITAL IMAGE PROCESSING | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To become familiar with digital image fundamentals.
- To get exposed to image enhancement techniques in Spatial and Frequency domain.
- To learn concepts of degradation function and restoration techniques.
- To study image segmentation and representation techniques.
- To become familiar with image compression and recognition methods.

UNIT I DIGITAL IMAGE FUNDAMENTALS 9

Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels - Color image fundamentals - RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transforms - DFT, DCT.

UNIT II IMAGE ENHANCEMENT 9

Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering – Smoothing and Sharpening Spatial Filtering, Frequency Domain: Introduction to Fourier Transform – Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Homomorphic filtering, Color image enhancement.

UNIT III IMAGE RESTORATION 9

Image Restoration - degradation model, Properties, Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering.

UNIT IV IMAGE SEGMENTATION 9

Edge detection, Edge linking via Hough transform – Thresholding - Region based segmentation – Region growing – Region splitting and merging – Morphological processing- erosion and dilation, Segmentation by morphological watersheds – basic concepts – Dam construction – Watershed segmentation algorithm.

UNIT V IMAGE COMPRESSION AND RECOGNITION 9

Need for data compression, Huffman, Run Length Encoding, Shift codes,

Arithmetic coding, JPEG standard, MPEG. Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors – Topological feature, Texture - Patterns and Pattern classes - Recognition based on matching

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Rafael C. Gonzalez, Richard E. Woods, "Digital Image Processing", Pearson, 3rd Edition, 2010, Fifth Edition. (Unit I – V)
2. Anil K. Jain, "Fundamentals of Digital Image Processing", Pearson, 2002. (Unit I – V)

REFERENCES:

1. Kenneth R. Castleman, "Digital Image Processing", Pearson, 2006.
2. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, "Digital Image Processing using MATLAB", Pearson Education, Inc., 2011.
3. D.E. Dudgeon and R. M. Mersereau, "Multidimensional Digital Signal Processing", Prentice Hall Professional Technical Reference, 1990.
4. William K. Pratt, "Digital Image Processing", John Wiley, New York, 4th Edition, 2007.
5. Milan Sonka, Vaclav Hlavac & Roger Boyle, "Image processing, Analysis and Machine Vision", Thomson Asia Pvt. Ltd, 4th Edition, 2015.
6. Sid Ahmed M.A., "Image Processing - Theory, Algorithm and Architecture", McGraw Hill, 2009

WEB REFERENCES:

1. Introduction to sensors: <http://www.shortcourses.com/sensors/>
2. Digital Image Fundamentals::
<http://www.ph.tn.tudelft.nl/Courses/FIP/Frames/fip.html>
3. DIAL-Digital Image Analysis Laboratory
<http://www.ece.arizona.edu/~dial/>
4. JPEG image compression standard: www.jpeg.org

ONLINE RESOURCES:

1. https://www.tutorialspoint.com/dip/image_processing_introduction.htm
2. <https://sisu.ut.ee/imageprocessing/book/1>

OUTCOMES:

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

1. Summarize the digital image acquisition concepts and color model fundamentals (K2).
2. Elaborate the image enhancement techniques in spatial and 2D

transform domain (K3).

- 3 Describe image degradation models and filtering techniques (K3).
- 4 Discuss types of image segmentation techniques and morphological operators (K2).
- 5 Identify image compression techniques (K2).
- 6 Utilize to represent image in form of boundary and regional descriptors (K2).

CO – PO, PSO MAPPING:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| C01 | 3 | 1 | - | - | - | - | - | - | - | - | - | - | - | - |
| C02 | 3 | 2 | 2 | 3 | 2 | - | - | - | - | - | 2 | 2 | 2 | 1 |
| C03 | 2 | 2 | 2 | 2 | 2 | - | - | - | - | - | 2 | 2 | 2 | 1 |
| C04 | 2 | 1 | 2 | 3 | 2 | - | - | - | - | - | 2 | - | 2 | 1 |
| C05 | 2 | 2 | 2 | 2 | 2 | - | - | - | - | - | 2 | 2 | 2 | 1 |
| C06 | 3 | 1 | 2 | 2 | 2 | - | - | - | - | - | 3 | 2 | 2 | 1 |

PROFESSIONAL ELECTIVE I

| | | | | | |
|-------------------------|-------------------------|---|---|---|---|
| 20CCEL510 SDG NO.4,9 | SENSOR NETWORKS AND IOT | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To explore the interconnection and integration of the physical world and the cyberspace
- To understand building blocks of Internet of Things and characteristics
- To design and develop IoT Device

UNIT I WIRELESS SENSOR NETWORKS FUNDAMENTALS

9

Wireless medium access issues MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wake Up Concepts - S-MAC , The Mediation Device Protocol, Wakeup Radio Concepts,Contention based protocols (CSMA, PAMAS) Schedule based protocols (LEACH, SMACS, TRAMA).

UNIT II ADDRESSING AND ROUTING MECHANISM

9

Address and Name Management in WSNs, Assignment of MAC Addresses

Routing Protocols- Energy-Efficient Routing, Geographic Routing, Hierarchical networks by clustering. Sensor deployment & Node discovery Data aggregation & dissemination.

UNIT III FUNDAMENTALS ON IOT

9

Definition of IoT and Characteristics of IoT- Physical and logical design of IoT- Functional blocks of IoT Communication models & APIs: Internet connectivity, Internet-based communication, IPv4, IPv6, 6LoWPAN protocol, IP Addressing in the IoT, Application layer protocols: HTTP, HTTPS, FTP, TELNET and ports.

UNIT IV M2M COMMUNICATION AND IoT

9

M2M communication and Modified OSI Model for the IoT/M2M Systems -Data enrichment, data consolidation and device management at IoT/M2M - Gateway Web communication protocols used by connected IoT/M2M devices - Message communication protocols (CoAP-SMS, CoAP-MQ, MQTT, XMPP) for IoT/M2M devices.

UNIT V IoT PROTOTYPING AND SECURITY

9

Introduction to Prototyping Embedded device software -Programming Embedded Device Arduino Platform using IDE -Reading data from sensors and devices, Devices-Gateways Internet and Web/Cloud services software development -Introduction to IoT privacy and security Vulnerabilities- security requirements and threat analysis- Domainspecific applications of IoT

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Vijay Madiseti, Arshdeep Bahga, "Internet of Things: A Hands-On Approach", Orient BlackSwan
2. Waltenege Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice", Wiley

RECOMMENDED BOOKS:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton, Jerome Henry, Rowan Trollope, "IoT Fundamentals : Networking Technologies, Protocols and Use Cases for the Internet of Things", Pearson
2. C. Siva Ram Murthy, B. S. Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols", Prentice Hall

OUTCOMES:

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

- 1 Understand the basic Protocols in Wireless Sensor Networks.(K2)

- 2 Discuss the Addressing and Routing Mechanism of Wireless Sensor Networks.(K2)
- 3 Understand the basic concepts of the Internet of Things.(K2)
- 4 Describe the M2M Communication Protocols & IoT.(K2)
- 5 Demonstrate the IoT applications in different domains on Embedded Platform.(K3)
- 6 Interpret the Security Features of IoT.(K2)

CO- PO, PSO MAPPING :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| C01 | 3 | 2 | 1 | - | - | - | 2 | 2 | 1 | - | 1 | 1 | 1 | 2 |
| C02 | 2 | 1 | 2 | - | 1 | 2 | 1 | - | - | 1 | - | 1 | 2 | 2 |
| C03 | 2 | 2 | 2 | 2 | 1 | 3 | 2 | - | 2 | 3 | - | 2 | 2 | 2 |
| C04 | 3 | 2 | 1 | - | 2 | 1 | 2 | 2 | 1 | 3 | 1 | 2 | 1 | 2 |
| C05 | 3 | 3 | 2 | 2 | 3 | 1 | 3 | 1 | 3 | 1 | 2 | 1 | 1 | 2 |
| C06 | 2 | 1 | 1 | 2 | 1 | 3 | 2 | 2 | 2 | 1 | 1 | 1 | 2 | 1 |

PROFESSIONAL ELECTIVE II

| | | | | | |
|--|---------------------------------|----------|----------|----------|----------|
| 20CCEL601 SDG NO.4, 9, 11, 15 | WIRELESS SENSOR NETWORKS | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- Learn adhoc network and sensor network fundamentals
- To understand the wireless sensor architecture
- Have an in-depth knowledge on sensor network and design issues
- To understand the infrastructure establishment of sensor networks
- Have an exposure to mote programming platforms and tools

UNIT I OVERVIEW OF WIRELESS SENSOR NETWORKS 9

Elements of adhoc Wireless Networks - Challenges for Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks.

UNIT II ARCHITECTURES 9

Single node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Operating Systems and Execution Environments, Network Architecture - Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts.

UNIT III NETWORKING SENSORS 9

Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols and Wakeup Concepts - S-MAC, The Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols- Energy-Efficient Routing, Geographic Routing.

UNIT IV INFRASTRUCTURE ESTABLISHMENT 9

Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.

UNIT V SENSOR NETWORK PLATFORMS AND TOOLS 9

Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Holger Karl, Andreas Willig, "Protocols And Architectures for Wireless Sensor Networks", John Wiley, 2005.
2. Feng Zhao & Leonidas J. Guibas, "Wireless Sensor Networks - An Information Processing Approach", Elsevier, 2007.

REFERENCES:

1. Kazem Sohraby, Daniel Minoli, Taieb Znati, "Wireless Sensor Networks Technology, Protocols and Applications", John Wiley, 2007.
2. Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2003.

OUTCOMES:

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

1. Know the basics of Ad Hoc networks and Wireless Sensor Networks (K2).
2. Explain the architecture and networking scenarios of Sensor Networks (K3).
3. To comprehend the functionalities of physical and data link layer with the knowledge of routing protocol (K3).
4. Illustrate the infrastructure establishment and network management (K4).
5. Demonstrate the OS used in Wireless Sensor Networks and build basic modules (K4).
6. Explain the sensor network platforms and the tools used to establish wireless connectivity (K2).

CO - PO, PSO MAPPING:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 2 | 0 | 3 | - | 1 | - | - | - | - | 3 | 3 | 2 | 2 |
| CO2 | 3 | 3 | 3 | 1 | 2 | 1 | - | - | - | - | 3 | 3 | 2 | 2 |
| CO3 | 3 | 3 | 2 | 1 | 3 | 1 | - | - | - | - | 3 | 3 | 2 | 2 |
| CO4 | 3 | 3 | 2 | 1 | 3 | 1 | - | - | - | - | 3 | 3 | 2 | 2 |
| CO5 | 3 | 3 | 2 | 1 | 1 | 3 | 1 | - | - | - | 3 | 3 | 2 | 2 |
| CO6 | 3 | 3 | 2 | 1 | 1 | 3 | 1 | - | - | - | 3 | 3 | 2 | 2 |

PROFESSIONAL ELECTIVE II

| | | | | | |
|-------------------------------------|------------------------|----------|----------|----------|----------|
| 20ECEL701 SDG NO.4 | COGNITIVE RADIO | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To understand the evolving software defined radio and cognitive radio techniques and their essential functionalities.
- To study the basic architecture and standard for cognitive radio.
- To understand the physical, MAC and Network layer design of cognitive radio.
- To expose the student to evolve applications and advanced features of cognitive radio

UNIT I INTRODUCTION TO SOFTWARE-DEFINED RADIO AND COGNITIVE RADIO 9

Evolution of Software Defined Radio and Cognitive radio: goals, benefits, definitions, architectures, relations with other radios, issues, enabling technologies, radio frequency spectrum and regulations.

UNIT II COGNITIVE RADIO ARCHITECTURE 9

Cognition cycle – orient, plan, decide and act phases, organization; SDR as a platform for Cognitive Radio – Hardware and Software Architectures; Overview of IEEE 802.22 standard for broadband wireless access in TV bands.

UNIT III SPECTRUM SENSING AND DYNAMIC SPECTRUM ACCESS 9

Introduction – Primary user detection techniques – energy detection, feature detection, matched filtering, cooperative detection and other approaches; Fundamental Tradeoffs in spectrum sensing; Spectrum Sharing Models of Dynamic Spectrum Access - Unlicensed and Licensed Spectrum Sharing; Fundamental Limits of Cognitive Radio.

UNIT IV MAC AND NETWORK LAYER DESIGN FOR COGNITIVE RADIO 9

MAC for cognitive radios – Polling, ALOHA, slotted ALOHA, CSMA, CSMA / CA; Network layer design – routing in cognitive radios, flow control and error control techniques.

UNIT V ADVANCED TOPICS IN COGNITIVE RADIO 9

Overview of security issues in cognitive radios, auction based spectrum markets in cognitive radio networks, public safety and cognitive radio, cognitive radio for Internet of Things.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Alexander M. Wyglinski, Maziar Nekovee, Thomas Hou, “Cognitive Radio Communications and Networks”, Academic Press, Elsevier, 2010. (Unit I to IV)
2. Huseyin Arslan(Ed.), “Cognitive Radio, Software Defined Radio and Adaptive Wireless Systems”, Springer, 2007. (Unit V)

REFERENCES:

1. Bruce Fette, “Cognitive Radio Technology”, Newnes, 2006.
2. Kwang-Cheng Chen, Ramjee Prasad, “Cognitive Radio Networks”, John Wiley and Sons, 2009.
3. Ezio Biglieri, Professor Andrea J. Goldsmith, Dr. Larry J. Greenstein, Narayan B. Mandayam, H. Vincent Poor, “Principles of Cognitive Radio”, Cambridge University Press, 2012.

WEB REFERENCES:

1. <https://www.classcentral.com/course/swayam-basics-of-software-defined-radios-and-practical-applications-10088>
2. <https://nptel.ac.in/courses/108107107/>
3. <https://www.ofcom.org.uk/research-and-data/technology/general/emerging-tech/cognitive-radio>

ONLINE RESOURCES:

1. https://link.springer.com/chapter/10.1007/978-981-10-4280-5_68
2. <https://www.sciencedirect.com/topics/computer-science/cognitive-radio-network>

OUTCOMES:

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

1. Elaborate on the architecture implications of software defined radio along with its radio frequency spectrum and regulations (K2)
2. Devise a Smart agent model in CR (K3)
3. Enumerate the Physical and Link layer parameters to improve the performance of communication link in CR (K3)
4. Discuss about the MAC schemes related to cognitive radio networks in detail (K2)

5. Make use of the concept of wireless networks to build next generation networks (K3)
6. Provide a review of security issues in cognitive network and CR- IoT framework with neat diagram (K2)

CO - PO, PSO MAPPING :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| C01 | 2 | 1 | 3 | 3 | 2 | 1 | 3 | 1 | 1 | 2 | 1 | 3 | 3 | - |
| C02 | 3 | 2 | 3 | 3 | 1 | 1 | 3 | 1 | 1 | 2 | 1 | 3 | 2 | - |
| C03 | 2 | 2 | 2 | 3 | 1 | 1 | 2 | 1 | 1 | 2 | 1 | 2 | 3 | 3 |
| C04 | 3 | 2 | 3 | 3 | 2 | 1 | 3 | 1 | 1 | 2 | 1 | 2 | - | 3 |
| C05 | 3 | 1 | 3 | 3 | 1 | 1 | 3 | 1 | 1 | 2 | 1 | 2 | - | 3 |
| C06 | 2 | 2 | 2 | 3 | 1 | 1 | 2 | 1 | 1 | 2 | 1 | 2 | 3 | 3 |

PROFESSIONAL ELECTIVE II

| | | | | | |
|-------------------------|--|---|---|---|---|
| 20CCEL602 SDG NO.4,9 | NETWORKING ENGINEERING AND MANAGEMENT | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To understand the need for interoperable network management
- To learn to the concepts and architecture behind standards based network management.
- To understand the concepts and terminology associated with SNMP
- To study the current trends in network management technologies.

UNIT I FOUNDATIONS OF NETWORKING

9

Communication Networks – Network Elements – Switched Networks and Shared media Networks – Probabilistic Model and Deterministic Model – Datagrams and Virtual Circuits – Multiplexing – Switching - Error and Flow Control – Congestion Control – Layered Architecture – Network Externalities – Service Integration – Modern Applications.

UNIT II QUALITY OF SERVICE

9

Traffic Characteristics and Descriptors – Quality of Service and Metrics – Best

Effort model and Guaranteed Service Model – Limitations of IP networks – Scheduling and Dropping policies for BE and GS models – Traffic Shaping algorithms – End to End solutions – Laissez Faire Approach – Possible improvements in TCP – Significance of UDP in inelastic traffic

UNIT III HIGH PERFORMANCE NETWORKS 9

Integrated Services Architecture – Components and Services – Differentiated Services Networks – Per Hop Behaviour – Admission Control – MPLS Networks – Scheduling Policy mechanisms – FIFO – Priority – Round Robin – Principles and Mechanisms – Label Stacking – RSVP – Protocols for Real time Interactive Application - RTP/RTCP.

UNIT IV HIGH SPEED NETWORKS 9

Optical links – WDM systems – Optical Cross Connects – Optical paths and Networks – Principles of ATM Networks – B-ISDN/ATM Reference Model – ATM Header Structure – ATM Adaptation Layer – Management and Control – Service Categories and Traffic descriptors in ATM networks – Wireless LAN – Architecture of IEEE 802.11.

UNIT V NETWORK MANAGEMENT 9

ICMP the Forerunner – Monitoring and Control – Network Management Systems – Abstract Syntax Notation – CMIP – SNMP Communication Model – SNMP MIB Group – Functional Model – Major changes in SNMPv2 and SNMPv3 – Remote monitoring – RMON SMI and MIB – Network Management Architecture – Security and privacy architecture.

TOTAL:45 PERIODS

TEXT BOOKS

1. Larry L Peterson and Bruce S Davie, 'Computer Networks: A Systems Approach', Fourth Edition, Morgan Kaufman Publishers, 2007. (Unit I and Unit II)
2. William Stallings, 'High Speed Networks: Performance and Quality of Service', 2nd Edition, Pearson Education, 2002. (Unit III)
3. Mani Subramaniam, 'Network Management: Principles and Practices', Pearson Education, 2000 (Unit IV and Unit V)

REFERENCES:

1. Mahbub Hassan and Raj Jain, 'High Performance TCP/IP Networking', Pearson Education, 2004.
2. Jean Warland and Pravin Vareya, 'High Performance Networks', Morgan Kauffman Publishers, 2002

3. Kasera and Seth, 'ATM Networks: Concepts and Protocols', Tata McGraw Hill, 2002.

OUTCOME:

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

- 1 Learn about communication networks, switched networks and shared networks. (K1)
- 2 Understand the concepts of error control, flow control and congestion control in wireless networks. (K2)
- 3 Analyze concepts of quality of service and traffic monitoring of IP networks. (K3)
- 4 Evaluate the concept of TCP and UDP in inelastic traffic. (K4)
- 5 Understand and acquire the concepts of Differential service networks and MPLS networks. (K2)
- 6 Outline the SNMP concepts and Network monitoring in terms of security. (K3)

CO- PO, PSO MAPPING :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | - | 3 | - | 3 | - | - | 3 | - | 3 | - | 3 | 1 | 1 | 1 |
| CO2 | - | 3 | - | 3 | | | 3 | - | 3 | - | 3 | 2 | 1 | 1 |
| CO3 | - | - | - | 2 | 2 | 3 | 2 | - | 2 | - | 2 | - | 2 | 1 |
| CO4 | 3 | 2 | - | - | - | 3 | 3 | - | 3 | - | 3 | 1 | 2 | 2 |
| CO5 | 3 | 2 | - | 3 | | 2 | | - | | - | - | 1 | 1 | 1 |
| CO6 | 3 | 2 | 2 | 1 | - | - | - | - | 2 | 2 | 3 | 1 | 3 | 3 |

PROFESSIONAL ELECTIVE II

| | | | | | |
|--------------------------------|----------------|---|---|---|---|
| 20ECEL502 SDG NO. 3,4,11,15 | INDUSTRIAL IoT | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- Introduce how IoT has become a game changer in the new economy where the customers are looking for integrated value
- Bring the IoT perspective in thinking and building solutions
- Introduce the tools and techniques that enable IoT solution and Security aspects

UNIT I INTRODUCTION**9**

Introduction to IOT, What is IIOT? IOT Vs. IIOT, History of IIOT, Components of IIOT -Sensors, Interface, Networks, People & Process, Hype cycle, IOT Market, Trends & future Real life examples, Key terms – IOT Platform, Interfaces, API, clouds, Data Management Analytics, Mining & Manipulation; Role of IIOT in Manufacturing Processes Use of IIOT in plant maintenance practices, Sustainability through Business excellence tools; Challenges & Benefits in implementing IIOT.

UNIT II ARCHITECTURES**9**

Overview of IOT components; Various Architectures of IOT and IIOT, Advantages & disadvantages, Industrial Internet - Reference Architecture; IIOT System components: Sensors, Gateways, Routers, Modem, Cloud brokers, servers and its integration, WSN, WSN network design for IOT.

UNIT III SENSOR AND INTERFACING**9**

Introduction to sensors, Transducers, Classification, Roles of sensors in IIOT, Various types of sensors, Design of sensors, sensor architecture, special requirements for IIOT sensors, Role of actuators, types of actuators. Hardwire the sensors with different protocols such as HART, MODBUS-Serial & Parallel, Ethernet, BACNet, Current, M2M etc.

UNIT IV PROTOCOLS AND CLOUD**9**

Need of protocols; Types of Protocols, Wi-Fi, Wi-Fi direct, Zigbee, Z wave, Bacnet, BLE, Modbus, SPI, I2C, IIOT protocols – COAP, MQTT, 6lowpan, lwm2m, AMPQ IIOT cloud platforms : Overview of cots cloud platforms, predix, thingworks, azure etc. Data analytics, cloud services, Business models: Saas, Paas, Iaas.

UNIT V PRIVACY, SECURITY AND GOVERNANCE**9**

Introduction to web security, Conventional web technology and relationship with IIOT, Vulnerabilities of IoT, Privacy, Security requirements, Threat analysis, Trust, IoT security tomography and layered attacker model, Identity establishment, Access control, Message integrity, Non-repudiation and availability, Security model for IoT, Network security techniques Management aspects of cyber security.

TOTAL: 45 PERIODS**TEXT BOOKS:**

- 1 Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications

- 2 Bernd Scholz-Reiter, Florian 2. Michahelles, “Architecting the Internet of Things”, ISBN 978-3- 642- 19156-5 e-ISBN 978-3-642-19157-2, Springer

REFERENCES:

1. Hakima Chaouchi, “ The Internet of Things Connecting Objects to the Web” ISBN : 978-1-84821-140-7, Willy Publications
2. Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key Applications and Protocols, ISBN: 978-1-119-99435-0, 2 nd Edition, Willy Publications
3. Inside the Internet of Things (IoT), Deloitte University Press
4. Internet of Things- From Research and Innovation to Market Deployment; By Ovidiu & Peter; River Publishers Series
5. Five thoughts from the Father of the Internet of Things; by By Phil Wainewright – Kevin Ashton
6. How Protocol Conversion Addresses IIoT Challenges: White Paper By RedLion.

WEB REFERENCES:

- 1 <https://nptel.ac.in/courses/106/105/106105195/>
- 2 <https://freevideolectures.com/course/4231/nptel-introduction-industry-industrial-internet-things>

ONLINE RESOURCES:

- 1 <https://www.coursera.org/lecture/digital-thread-implementation/the-industrial-internet-of-things-iiot-za9wH>
- 2 https://swayam.gov.in/nd1_noc20_cs24/preview

OUTCOMES:

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

1. Review the components and key terms in IOT (K1)
2. Describe the architectures of IOT, IIOT (K1)
3. Understand, design and develop the real life IoT applications using off the shelf hardware and software (K1)
4. Understand various IoT layers and their relative importance (K1)
5. Study various IoT platforms and Security (K1)
6. Realize the importance of Data Analytics in IoT (K1)

CO – PO, PSO MAPPING :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| C01 | 3 | 1 | - | - | - | - | - | - | - | - | 1 | 1 | 1 | 1 |
| C02 | 3 | 1 | 2 | 2 | - | 2 | - | - | - | - | 2 | 2 | 3 | 2 |
| C03 | 3 | 1 | 3 | 2 | - | 2 | - | - | - | - | 2 | 2 | 3 | 2 |
| C04 | 3 | 1 | 3 | 2 | - | 2 | - | - | - | - | 2 | 2 | 3 | 2 |
| C05 | 3 | 1 | 3 | 2 | 2 | 2 | - | - | - | - | 2 | 2 | 3 | 2 |
| C06 | 3 | 1 | 3 | 2 | 2 | 2 | - | - | 2 | 3 | 2 | 2 | 3 | 2 |

PROFESSIONAL ELECTIVE II

| | | | | | |
|-------------------------------------|------------------------------------|----------|----------|----------|----------|
| 20CSEL704 SDG NO.4 | NATURAL LANGUAGE PROCESSING | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To learn the techniques in natural language processing
- To be familiar with the natural language generation
- To be exposed to machine translation
- To understand the information retrieval techniques

UNIT I OVERVIEW AND LANGUAGE MODELING**9**

Overview: Origins and Challenges of NLP-Language and Grammar - Processing Indian Languages - NLP Applications - Information Retrieval - Language Modeling - Various Grammar - Based Language Models-Statistical Language Model.

UNIT II WORD LEVEL AND SYNTACTIC ANALYSIS**9**

Word Level Analysis - Regular Expressions-Finite-State Automata-Morphological Parsing-Spelling Error Detection and Correction-Words and Word Classes-Part-of Speech Tagging - Syntactic Analysis - Context-Free Grammar-Constituency- Parsing-Probabilistic Parsing.

UNIT III SEMANTIC ANALYSIS AND DISCOURSE PROCESSING**9**

Semantic Analysis: Meaning Representation-Lexical Semantics - Ambiguity-Word Sense Disambiguation - Discourse Processing - Cohesion-Reference Resolution- Discourse Coherence and Structure.

UNIT IV N A T U R A L L A N G U A G E G E N E R A T I O N AND MACHINE TRANSLATION 10

Natural Language Generation - Architecture of NLG Systems- Generation Tasks and Representations- Application of NLG - Machine Translation - Problems in Machine Translation - Characteristics of Indian Languages - Machine Translation Approaches - Translation Involving Indian Languages.

UNIT V INFORMATION RETRIEVAL AND LEXICAL RESOURCES 8

Information Retrieval - Design features of Information Retrieval Systems- Classical - Non-classical - Alternative Models of Information Retrieval – Valuation Lexical Resources - World Net-Frame Net- Stemmers - POS Tagger- Research Corpora.

TOTAL: 45 PERIODS

TEXT BOOK:

1. Tanveer Siddiqui, U.S. Tiwary, “Natural Language Processing and Information Retrieval”, Oxford University Press, 2008.
2. Steven Bird, Ewan Klein and Edward Loper, “Natural Language Processing with Python”, First Edition, O_Reilly Media, 2009.

REFERENCES:

1. Daniel Jurafsky and James H Martin, “Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition”, 2nd Edition, Prentice Hall, 2008.
2. James Allen, “Natural Language Understanding”, 2nd edition, Benjamin / Cummings publishing company, 1995.
3. Hobson lane, Cole Howard, Hannes Hapke, “Natural language processing in action” MANNING Publications, 2019.
4. Alexander Clark, Chris Fox, Shalom Lappin, “The Handbook of Computational Linguistics and Natural Language Processing”, Wiley-Blackwell, 2012.
5. Anne Kao and Stephen R. Poteet (Eds), “Natural Language Processing and Text Mining”, Springer-Verlag London Limited, 2007.

WEB REFERENCES:

1. https://www.tutorialspoint.com/natural_language_processing/natural_language_processing_information_retrieval.htm
2. <https://towardsdatascience.com/your-guide-to-natural-language-processing-nlp-48ea2511f6e1>

3. <https://machinelearningmastery.com/natural-language-processing/>
4. <https://becominghuman.ai/a-simple-introduction-to-natural-language-processing-ea66a1747b32>

ONLINE RESOURCES:

1. <https://www.coursera.org/learn/language-processing>
2. <https://www.youtube.com/playlist?list=PLoROMvodv4rOhcuxMZkNm7j3fVwBBY42z>

OUT COMES:

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

1. Learn the approaches of syntax and semantics in NLP. (K1)
2. Understand approaches to discourse, generation, dialogue and summarization within NLP. (K1)
3. Implement current methods for statistical approaches to machine translation. (K3)
4. Analyse machine learning techniques used in NLP. (K3)
5. Apply information retrieval techniques. (K2)
6. Develop a Statistical Methods for Real World Applications and explore deep learning based NLP. (K3)

CO- PO, PSO MAPPING:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 3 | 3 | 3 | 3 | - | - | - | 1 | 2 | - | 1 | 2 | 2 |
| CO2 | 2 | 3 | 3 | 2 | 3 | 2 | - | 1 | 3 | 1 | 2 | 2 | 3 | 2 |
| CO3 | 3 | 3 | 2 | 2 | - | - | - | 1 | 2 | 1 | 3 | 2 | 1 | 1 |
| CO4 | 3 | 3 | 1 | - | 3 | - | - | 2 | 1 | 1 | - | 1 | 2 | 1 |
| CO5 | 3 | 3 | 3 | 3 | 3 | - | - | 1 | 1 | 1 | 2 | 1 | 1 | 1 |
| CO6 | 2 | 2 | 1 | - | 1 | 1 | - | - | - | - | 1 | 1 | 2 | 2 |

PROFESSIONAL ELECTIVE II

| | | | | | |
|-------------------------------------|---------------------------------|----------|----------|----------|----------|
| 20MGEL601 SDG NO.4 | TOTAL QUALITY MANAGEMENT | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To understand the concepts and philosophies of Quality Management
- To know the impact and significance of TQM principles on organizations in recent times.

UNIT 1 INTRODUCTION

8

Need and Evolution of Quality, Quality-Definitions, statements and dimensions of product and service quality TQM-concepts, Elements and Framework, Benefits & Obstacles of TQM , TQM-Culture, Strategic Quality Management, Costs of Quality.

UNIT II CONTRIBUTIONS AND APPROACHES TO QUALITY MANAGEMENT

9

Renowned quality gurus- Deming, Juran, Crosby and Ishikawa, Contributions of Taguchi – Loss Function, Signal to Noise Ratio and design of experiments, Kaizen -principles and practices-5 S tools, Poka Yoke-8Discipline Methodology, Just in time, Continous process improvement-PDCA cycle and 5 why analysis

UNIT III CUSTOMER FOCUS AND TEAMWORK

8

Identifying Customer Needs, QFD - Process, Building HoQ, Customer Satisfaction Measurement Techniques. Employee Involvement Practices. Individual Participation - Suggestion Systems & Empowerment, Motivation, Leadership, Partnerships - Cross-Functional Teams, Supplier/Customer Partnerships, Problem-Solving Teams - Quality Circles.

UNIT IV STATISTICAL TOOLS & TECHNIQUES

11

SQC - Tools For Data Collection And Analysis – Seven tools(old and new),Statistical Process Control (SPC) – Construction of Control Chart – Variables and Attributes. Process Capability – concepts and measurement. Six Sigma models, Lean six sigma, BPR, TPM, FMEA and Benchmarking.

UNIT V QUALITY SYSTEMS AND STANDARDS

9

Need for ISO 9000- ISO 9001: 2015 quality system-guidelines and clausewise requirements, Quality audits-types and responsibilities, ISO 14001:2004 EMS,

ISO / TS 16949:2002, ISO 27001:2005 ISMS, SEI – CMMI and Awards - Demings Prize, MBNQA and criteria.

TOTAL:45PERIODS

TEXT BOOKS:

1. Besterfield, Total Quality Management, 3rd Edition, Pearson India
2. Shridhara K Bhat, Total Quality Management. Himalaya Publishing House, 2010.

REFERENCE BOOKS:

1. Bedi Kanishka, Quality Management, Oxford University Press
2. Kiran D.R., Total Quality Management - Key Concepts and Case Studies, Butterworth-Heinemann, 2016.
3. Poornima M Charantimath, Total Quality Management. Pearson India, 2017
4. Sharma DD, Total Quality Management, Principles, Practice and Cases, Sultan Chand and Sons.
5. Douglas C. Montgomery, Introduction to Statistical Quality Control, Wiley Student Edition, 4 th Edition, Wiley India Pvt Limited, 2008

MOOC REFERENCES:

1. <https://www.coursera.org/lecture/supply-chain-management/total-quality-management-wLrvy>
2. https://swayam.gov.in/nd1_noc20_mg34/preview
3. <https://www.openlearning.com/courses/total-quality-management/>
4. <https://www.udemy.com/course/tqm-in-academics/>

MOOC REFERENCES:

1. https://www.unido.org/sites/default/files/2009-04/A_roadmap_to_quality_volume_1_0.pdf
2. <https://www.investopedia.com/terms/t/total-quality-management-tqm.asp>
3. https://www.researchgate.net/publication/237006071_Total_Quality_Management_in_Academic_Libraries_A_Study
4. <https://www.isixsigma.com/methodology/total-quality-management-tqm/introduction-and-implementation-total-quality-management-tqm/>
5. <https://study.com/academy/lesson/five-principles-of-total-quality-management-tqm.html>

OUTCOMES:

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

1. Understand quality concepts and philosophies of TQM. (K2)
2. Apply TQM principles and concepts of continuous improvement. (K3)
3. Explain the quality tools, management tools and statistical fundamentals to improve quality. (K2)
4. Demonstrate the various TQM tools as a means to improve quality. (K2)
5. Illustrate quality tools and procedures for better quality output. (K3)

CO- PO, PSO MAPPING :

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

PROFESSIONAL ELECTIVE II

| | | | | | |
|---------------------------------------|---|----------|----------|----------|----------|
| 20CCEL603 SDG NO.4,9 | ADVANCED DATASTRUCTURES AND ALGORITHMS | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To solve problems using different data structures and design techniques and to compare their performance, tradeoffs.
- To learn appropriate use and choice of standard data structures.
- To develop recursive algorithms for various applications.

UNIT I FUNDAMENTALS**9**

Mathematical Induction - Asymptotic Notations - Properties of Big-oh Notation - Conditional Asymptotic Notation - Algorithm Analysis - Amortized Analysis - NP-Completeness - NP-Hard - Recurrence Equations - Solving Recurrence Equations - Memory Representation of Multi-dimensional Arrays - Time-Space Tradeoff.

UNIT II HEAP STRUCTURES**9**

Min/Max heaps – Array-Based Heaps - Heap-Ordered Trees and Half-Ordered Trees - Deaps – Leftist Heaps – Binomial Heaps: Structure – Operations - Changing Keys in Heaps – Fibonacci Heaps – Skew Heaps – Lazy- Binomial Heaps.

UNIT III SEARCH STRUCTURES**9**

Binary Search Trees – Self balancing Binary Search Trees – Applications – The concept of balancing and its advantages – AVL Trees : Single and Double rotations – Red-Black trees – Multi-way Search Trees – B-Trees: Operations: Insert and Delete – Splay Trees : Rotation – Tries.

UNIT IV MULTIMEDIA STRUCTURES**9**

Segment Trees – k-d Trees: Node structure – 2-D trees – insertion - deletion – Point Quad Trees: insertion – deletion - Expanded Node Type – Range Searches – MX-Quad Trees: Range Queries – R-Trees – TV-Trees: Node Structure – Search - Insertion – Deletion - Extending and contracting.

UNIT V ALGORITHMS**9**

Huffman Coding – Convex Hull – Topological Sort – Tree Vertex Splitting – Activity Networks – Flow Shop Scheduling – Counting Binary Trees – Introduction to Randomized Algorithms.

TOTAL:45 PERIODS**TEXT BOOKS**

1. E. Horowitz, S.Sahni and Dinesh Mehta, Fundamentals of Data structures in C++, Uiversity Press, 2007.
2. E. Horowitz, S. Sahni and S. Rajasekaran, Computer Algorithms/C++, Second Edition, University Press, 2007.
3. V.S. Subramanian, Principles of Multimedia Database systems, Morgan Kaufman, 1998.

REFERENCES

1. G. Brassard and P. Bratley, Algorithmics: Theory and Practice, Prentice -Hall, 1988.

OUTCOMES:

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

1. Understand the properties of Big-oh Notation and Conditional Asymptotic Notation
2. Solve NP-Completeness and NP-Hard problem

3. Analyze different types of Heaps and its structure.
4. Able to create Heap Structure for different types of Heaps
5. Learn about different types of trees like AVL Trees, Red-Black trees and B-Trees

CO- PO, PSO MAPPING :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 2 | 0 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 3 | 3 | 2 | 2 |
| CO2 | 3 | 3 | 3 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 3 | 3 | 2 | 2 |
| CO3 | 3 | 3 | 2 | 1 | 3 | 1 | 0 | 0 | 0 | 0 | 3 | 3 | 2 | 2 |
| CO4 | 3 | 3 | 2 | 1 | 3 | 1 | 0 | 0 | 0 | 0 | 3 | 3 | 2 | 2 |
| CO5 | 3 | 3 | 2 | 1 | 1 | 3 | 1 | 0 | 0 | 0 | 3 | 3 | 2 | 2 |
| CO6 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 0 | 0 | 0 | 3 | 3 | 2 | 1 |

PROFESSIONAL ELECTIVE II

| | | | | | | | | |
|-------------------------|-------------------------|--|--|--|----------|----------|----------|----------|
| 20ITEL601 SDG NO.4,9 | SOFTWARE TESTING | | | | L | T | P | C |
| | | | | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To learn the criteria and design of Test Cases
- To learn the design of Test Cases
- To understand Test Management and Test Automation Techniques
- To apply Test Metrics and Measurements

UNIT I INTRODUCTION

9

Testing as an Engineering Activity – Testing as a Process – Testing Maturity Model - Basic Definitions – Software Testing Principles – The Tester's Role in a Software Development Organization – Origins of Defects – Cost of Defects – Defect Classes – The Defect Repository and Test Design – Defect Examples- Developer/Tester Support of Developing a Defect Repository.

UNIT II TEST CASE DESIGN STRATEGIES

9

Test Case Design Strategies – Using Black Box Approach to Test Case Design – Boundary Value Analysis – Equivalence Class Partitioning – State Based Testing – Cause-Effect Graphing – Compatibility Testing – User

Documentation Testing – Domain Testing - Random Testing – Requirements Based Testing – Using White Box Approach to Test design – Test Adequacy Criteria – Static Testing Vs. Structural Testing – Code Functional Testing – Coverage and Control Flow Graphs – Covering Code Logic – Paths – Code Complexity Testing – Additional White Box Testing Approaches.

UNIT III LEVELS OF TESTING

9

The Need for Levels of Testing – Unit Test – Unit Test Planning – Designing the Unit Tests – The Test Harness – Running the Unit Tests and Recording Results – Integration Tests – Designing Integration Tests – Integration Test Planning – Scenario Testing – Defect Bash Elimination System Testing – Acceptance Testing – Performance Testing – Regression Testing – Internationalization Testing – Ad Hoc Testing – Alpha, Beta Tests – Testing Object Oriented Systems – Usability and Accessibility Testing – Configuration Testing – Compatibility Testing – Testing the Documentation – Website Testing.

UNIT IV TEST MANAGEMENT

9

People and Organizational Issues in Testing – Organization Structures for Testing Teams – Testing Services – Test Planning – Test Plan Components – Test Plan Attachments – Locating Test Items – Test Management – Test Process – Reporting Test Results – Introducing the Test Specialist – Skills Needed by a Test Specialist – Building a Testing Group- The Structure of Testing Group - The Technical Training Program.

UNIT V TEST AUTOMATION

9

Software Test Automation – Skills needed for Automation – Scope of Automation – Design and Architecture for Automation – Requirements for a Test Tool – Challenges in Automation – Test Metrics and Measurements – Project, Progress and Productivity Metrics.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Srinivasan Desikan and Gopalaswamy Ramesh, “Software Testing – Principles and Practices”, Pearson Education, 2006.
2. Ron Patton, “Software Testing Second Edition”, Sams Publishing, Pearson Education, 2007.

REFERENCES:

1. Ilene Burnstein, “Practical Software Testing”, Springer International Edition, 2003.
2. Edward Kit, “Software Testing in the Real World – Improving the Process”, Pearson Education, 1995.

3. Boris Beizer, "Software Testing Techniques" 2nd Edition, Van Nostrand Reinhold, New York, 1990.
4. Aditya P. Mathur "Foundations of Software Testing - Fundamental Algorithms and Techniques", Dorling Kindersley (India) Pvt. Ltd., Pearson Education, 2008.
5. Naresh Chauhan-Software Testing Principles and Practices, 2nd Edition, Oxford University Press, 2017.

WEB REFERENCES :

1. <https://nptel.ac.in/courses/106/105/106105150/>

ONLINE RESOURCES:

1. <https://www.javatpoint.com/software-testing-tutorial>
2. <https://www.toolsqa.com/software-testing-tutorial/>

OUTCOMES:

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

1. Understand about the Software Testing Principles and Defect Classes (K2)
2. Apply test cases suitable for software development for different domains (K3)
3. Discuss the various Levels of Testing (K2)
4. Identify suitable tests to be carried out. (K2)
5. Discuss the concepts of Test plan and its skill set (K2)
6. Apply automatic testing tools and discuss the various test metrics and measurements. (K3)

CO-PO, PSO MAPPING:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| C01 | 2 | 1 | - | - | - | - | - | - | - | - | 2 | - | 2 | 3 |
| C02 | 2 | 3 | 3 | - | - | - | - | - | 2 | - | 1 | - | 3 | 3 |
| C03 | 2 | 3 | 3 | - | - | - | - | - | 3 | - | 1 | 2 | 3 | 3 |
| C04 | 2 | 3 | 3 | - | - | - | - | - | 3 | - | 3 | 3 | 3 | 3 |
| C05 | - | 2 | 1 | - | - | - | - | - | 2 | - | 2 | - | 3 | 3 |
| C06 | 3 | 2 | 2 | - | - | - | - | - | 1 | 2 | 2 | 2 | 3 | 3 |

PROFESSIONAL ELECTIVE II

| | | | | | |
|---------------------------------------|--------------------|----------|----------|----------|----------|
| 20CCEL604 SDG NO.4,9 | INFOMETRICS | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To understand the information properties of scientific and technical data.
- To learn how to measure and evaluate aspects of research data set usability.
- To have hands-on experience with data science and informatics tools

UNIT I IT ORGANIZATION

9

Metrics that matter - Interpreting the metrics – Collecting the data – Managing the data – Obstacles to acquiring IT metrics information – Old data versus new graphical analysis – Core of software planning – Measuring the core metrics (Product, Quality, Process, Productivity, Time, Effort) – Estimating and controlling with the core metrics – Work output measurements.

UNIT II MEASUREMENT PROGRAM APPROACHES

9

EDS Brazil metrics program – Measurement program implementation approaches : Assessing measurement frame work and guidelines– Bench marking: conceptual model for bench marking, semantics annotations – Data definition framework for defining software measurements.

UNIT III SOFTWARE METRICS

9

Functional points as part of measurement program :mean time ,detect density, customer problem ,customer satisfaction– Estimation of software reliability – Establishing central support for software sizing activities – Using metrics to manage projects – Tracking software progress – Effectively utilizing software metrics.

UNIT IV SOFTWARE ESTIMATION

9

Problems with measurements – Avoiding obstacles and common pitfalls – Unreported and unpaid overtime – Using software metrics for effective estimating – Estimating software development projects – Enhanced estimation on time within budget – Metrics in outsourcing – Lifigaton – The product of non practicing function point metrics – Applying statistical process central to software – Metrics in E-Commerce.

UNIT V SOFTWARE DEFECT MANAGEMENT**9**

Literature review – Defect removal effectiveness and quality planning : early detection of software errors, phase based defect removal model, characteristics of special case phase 2 model – Quality planning – Cost effectiveness of phase defect removal – Process maturity:

TOTAL:45 PERIODS**TEXT BOOK**

1. Stephen H. Kan, “ Metrics and Models In Software Quality Engineering”, First Edition, Pearson Education, 2003.

REFERENCES

1. N. Fenton, S. L. Pfleeger, “Software Metrics: A Rigorous and Practical Approach”, Thomson Learning, 1997.
2. IT Measurement – A Practical Advice from the Experts”, International Function Point Users Group, Pearson Education, 2002.

OUTCOME:**At the end of this course, the student will be able to**

- 1 Understand the concept of Obstacles to acquiring IT metrics information (K2)
- 2 Learn the concept of Estimating and controlling with the core metrics (K1)
- 3 Determine EDS Brazil metrics program. (K2)
- 4 Analyze Tracking software progress (K3)
- 5 Discuss the topic Functional points as part of measurement program. (K2)
- 6 Interpret the software defect management process using various metrics. (K3)

CO- PO, PSO MAPPING :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| C01 | 1 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 2 |
| C02 | 1 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 2 |
| C03 | 2 | 3 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 1 |
| C04 | 0 | 3 | 0 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 1 |
| C05 | 1 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | - |
| C06 | 1 | 2 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 1 | 2 |

PROFESSIONAL ELECTIVES - II

| | | | | | |
|-------------------------------|----------------------------------|----------|----------|----------|----------|
| 20CSEL702 SDG NO. 4 | SOFTWARE DEFINED NETWORKS | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To appreciate the need for Software Defined Networks
- To learn working of Software Defined Networking
- To know the Open Flow Specifications
- To know the applications of Software Defined Networking in Data Centers

UNIT I INTRODUCTION 9

Basic Packet Switching Terminology - The Modern Data Center - Traditional Switch Architecture - Autonomous and Dynamic Forwarding Tables - Open Source and Technological Shifts - SDN - Evolution of Switches - Control Planes - Cost - SDN Implications for Research and Innovation - Data Center Innovation - Data Center Needs.

UNIT II THE GENESIS OF SDN 9

The Evolution of Networking Technology - Sustaining SDN Interoperability - Open Source Contributions - Legacy Mechanisms Evolve Toward SDN - Network Virtualization - Fundamental Characteristics of SDN - SDN Operation - SDN Devices - SDN Controller - SDN Applications - Alternate SDN Methods.

UNIT III THE OPENFLOW SPECIFICATION 9

OpenFlow Overview - OpenFlow 1.0-1.1-1.2-1.3 - OpenFlow - Limitations - Alternative Definitions of SDN - Potential Drawbacks of Open SDN - SDN via APIs - SDN via Hypervisor - Based Overlays - SDN via Opening Up the Device - Network Functions Virtualization - Alternatives Overlap and Ranking.

UNIT IV SDN IN THE DATA CENTER 9

Data Center Definition - Data Center Demands - Tunneling Technologies for the Data Center; Path Technologies in the Data Center - Ethernet Fabrics in the Data Center - SDN Use Cases in the Data Center - Open SDN versus Overlays in the Data Center - Real-World Data Center Implementations.

SDN IN OTHER ENVIRONMENTS: Consistent Policy Configuration - Global Network View - Wide Area Networks - Service Provider and Carrier Networks - Campus Networks - Hospitality Networks - Mobile Networks - In-Line Network Functions - Optical Networks - SDN vs P2P/Overlay Networks.

UNIT V SDN APPLICATIONS**9**

Reactive versus Proactive Applications - Reactive SDN Applications - Proactive SDN Applications - Analyzing Simple SDN Applications - Creating Network Virtualization Tunnels - Offloading Flows in the Data Center - Access Control for the Campus - Traffic Engineering for Service Providers.

SDN FUTURES: Potential Novel Applications of Open SDN - Applying Programming Techniques to Networks - Security Applications - Hiding IP Addresses - Segregating IPSec Traffic in Mobile Networks - Roaming in Mobile

TOTAL: 45 PERIODS**TEXT BOOKS:**

1. Paul Goransson, Chuck Black, "Software Defined Networks - A Comprehensive Approach", Elsevier, 2014.
2. Siamak Azodolmolky, "Software Defined Networking with Open Flow", Second Edition, Packt Publishing, 2013.

REFERENCES:

1. Thomas D.Nadeau & Ken Gray, "SDN Software Defined Networks", O'Reilly publishers, First edition, 2013.
2. Sreenivas Voruganti, Sriram Subramanian, "Software Defined Networking (SDN) with Open Stack", First Edition, Packt Publishing, 2016.
3. William Stallings, "Foundations of Modern Networking", First Edition, Pearson education limited, 2016.
4. Vivek Tiwari, "SDN and Open Flow for Beginners", Amazon Digital Services, Inc., 2013.
5. Fei Hu, Editor, "Network Innovation through Open Flow and SDN: Principles and Design", Chemical Rubber Company Press, 2014.

WEB REFERENCES:

1. https://users.cs.fiu.edu/~fortega/storage/tcn6430/SDN_9780124166844.pdf
2. <https://www.cs.rutgers.edu/~sn624/552-F18/papers/p4.pdf>
3. <https://www.cs.rutgers.edu/~sn624/552-F18/papers/road.pdf>

ONLINE RESOURCES:

1. <https://sdn.ieee.org/outreach/resources>
2. <https://www.coursera.org/learn/sdn>

OUTCOMES:**Upon completion of the course, the student should be able to**

1. Explain the key benefits of SDN by the separation of data and control planes (K1)
2. Interpret the SDN data plane devices and Openflow Protocols.(K2)
3. Implement the operation of SDN control plane with different controllers.(K2)
4. Apply techniques that enable applications to control the underlying network using SDN.(K3)
5. Appreciate the applications of Software Defined Networking in Data Centers (K2)
6. Describe Network Functions Virtualization components and their roles in SDN(K3)

CO- PO, PSO MAPPING

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| C01 | 3 | - | 3 | 2 | - | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | - |
| C02 | 1 | 3 | 1 | 2 | - | 1 | - | 3 | 1 | - | 1 | 1 | 1 | 3 |
| C03 | 3 | 3 | 3 | 3 | 1 | - | - | - | 3 | 1 | 3 | 3 | 3 | 3 |
| C04 | 3 | 3 | 3 | 3 | 3 | 2 | - | 2 | 2 | 1 | 3 | 2 | 3 | 3 |
| C05 | 3 | 3 | 3 | 3 | 3 | 1 | - | - | 1 | 1 | 3 | 2 | 3 | 3 |
| C06 | 3 | 3 | 3 | 2 | 3 | 2 | - | 2 | 2 | 1 | 3 | 2 | 3 | 3 |

PROFESSIONAL ELECTIVE III

| | | | | | |
|-------------------------------------|----------------------------------|----------|----------|----------|----------|
| 20CCEL701 SDG NO.4 | ADHOC AND SENSOR NETWORKS | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- Understand the design issues in ad hoc and sensor networks. Learn the different types of MAC protocols.
- Be familiar with different types of adhoc routing protocols.
- Be expose to the TCP issues in adhoc networks.
- Learn the architecture and protocols of wireless sensor networks.

UNIT I INTRODUCTION

9

Characteristics of wireless channel - Wireless local loop - IEEE 802.16 standard – HIPERACCESS -Ad hoc wireless networks: Introduction and issues - MAC protocols: Design issues - Goals and classification - MACAW: A media access protocol for wireless LANs Distributed packet reservation multiple access protocol-Distributed priority scheduling and Medium access in Ad hoc networks- MAC protocol using directional antennas.

UNIT II ROUTING PROTOCOLS

9

Design issues – Classification – Wireless routing protocol - Location aided routing- Zone routing protocol - Hierarchical state routing protocol - Power aware routing protocol – Operation of multicast routing protocols - Classification of multicast routing protocols – Application-Dependent multicast routing.

UNIT III SECURITY IN AD HOC NETWORKS

9

Security in ad hoc wireless networks – Network security requirements - Issues and challenges in security provisioning – Network security attacks – key management – secure routing in Ad hoc Networks

UNIT IV WIRELESS SENSOR NETWORKS

9

Architecture - Data dissemination - Data gathering - MAC protocols - Location discovery - Quality of sensor networks - Case study

UNIT V SENSOR NETWORK DATABASE

9

Sensor database challenges – Querying the physical environment – Query interfaces - High level database organization – In-Network aggregation – Temporal data – Emerging Applications.

TOTAL: 45 PERIODS

TEXT BOOK:

1. C. Siva Ram Murthy, and B. S. Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols ",Prentice Hall Professional Technical Reference,2008.
2. Toh C.K, "Ad hoc Mobile Wireless Networks: Protocols And Systems", Prentice Hall PTR, First edition 2002

REFERENCES:

1. Mohammad Ilyas, –The Handbook Of Ad hoc Wireless Networks||, CRC press, 2002
2. Charles E. Perkins, –Ad hoc Networking||, Addison –Wesley,2000
3. Stefano Basagni , et al – Mobile Ad hoc Networking||, Wiley –IEEE press,2004
4. Zhao, Guibas ||Wireless Sensor Networks|| ,Morgan Kaufmann Publications,2004

OUTCOMES:**Upon completion of the course, the student should be able to:**

- 1 Explain the concept of ad hoc and sensor networks, their applications and typical node and network architectures. (K2)
- 2 Summarize the Concepts of MAC Protocol (K2)
- 3 Compare wireless routing protocol's function and their implications on network performance. (K3)
- 4 Explain various security threats to ad hoc networks and describe proposed solutions. (K2)
- 5 Explain the sensor network characteristics, sensor databases and query processing. (K2)
- 6 Analyze the protocol design issues of ad hoc and sensor networks (K3)

CO- PO, PSO MAPPING :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| C01 | 3 | 2 | - | - | - | 2 | - | - | - | - | - | - | - | - |
| C02 | 3 | 2 | - | - | - | | - | - | - | - | - | - | - | - |
| C03 | 3 | 2 | - | - | - | | - | - | - | - | - | - | - | - |
| C04 | 3 | 2 | - | 2 | - | | - | - | - | - | - | - | - | - |
| C05 | 3 | 2 | - | 2 | - | | - | - | - | - | - | - | - | 2 |
| C06 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | - |

PROFESSIONAL ELECTIVE III

| | | | | | |
|---|-----------------------------------|----------|----------|----------|----------|
| 20CCEL702 SDG NO.4,8,9 | HUMAN COMPUTER INTERACTION | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- Learn the foundations of Human Computer Interaction
- Be familiar with the design technologies for individuals and persons with disabilities
- Be aware of mobile HCI
- Learn the guidelines for user interface.
- Learn HCI implications for designing multimedia/ e-commerce/ e-learning Web sites

UNIT I FOUNDATIONS OF HCI

9

The Human: I/O channels – Memory – Reasoning and problem solving; The computer: Devices – Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms.

UNIT II DESIGN & SOFTWARE PROCESS

9

Interactive Design basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process – software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules – principles, standards, guidelines, rules. Evaluation Techniques – Universal Design.

UNIT III MODELS AND THEORIES

9

Cognitive models – Socio-Organizational issues and stake holder requirements – Communication and collaboration models- Hypertext, Multimedia and WWW.

UNIT IV MOBILE HCI

9

Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools.

UNIT V WEB INTERFACE DESIGN

9

Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow. Case Studies.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human Computer Interaction", 3rd Edition, Pearson Education, 2004
2. Brian Fling, "Mobile Design and Development", First Edition , O'Reilly Media Inc., 2009
3. Bill Scott and Theresa Neil, "Designing Web Interfaces", First Edition, O'Reilly, 2009.

REFERENCES:

1. G. Abowd. Agents: recognition and interaction models. In D. Diaper, D. Gilmore, G. Cockton, and B. Shackel, editors, Human-Computer Interaction - Proceedings INTERACT'90, pages 143-146. North-Holland, Amsterdam, 1990.
2. H. Alexander. Formally-based Tools and Techniques for Human-Computer Dialogues. Ellis Horwood, Chichester, 1987.

WEB REFERENCES:

1. <https://www.coursera.org/learn/human-computer-interaction>
2. <https://nptel.ac.in/courses/106106177/>

ONLINE COURSES:

1. https://www.youtube.com/playlist?list=PLLsST5z_DsK_nusHL_Mjt87THSTlgrsy
2. <https://www.youtube.com/playlist?list=PL9D89E1E0B8510EC5>

OUTCOMES:

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

- 1 Summarize the Foundation of HCI (K2)
- 2 Interpret the Interactive Design Process (K2)
- 3 Infer Prototyping HCI in Software Process (K2)
- 4 Summarize the Different Models and Theories in Software Design (K2)
- 5 Interpret the Concepts of Mobile HCI (K2)
- 6 Explain the HCI implications for designing multimedia/ ecommerce/ e-learning Web sites (K2)

CO- PO, PSO MAPPING :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| C01 | 3 | 2 | - | - | - | 2 | - | - | - | - | - | - | - | - |
| C02 | 3 | 2 | - | - | - | | - | - | - | - | - | - | - | - |
| C03 | 3 | 2 | - | - | - | | - | - | - | - | - | - | - | - |
| C04 | 3 | 2 | - | 2 | - | | - | - | - | - | - | - | - | - |
| C05 | 3 | 2 | - | 2 | - | | - | - | - | - | - | - | - | 2 |
| C06 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | - |

PROFESSIONAL ELECTIVE III

| | | | | | |
|---------------------------------------|--------------------------|----------|----------|----------|----------|
| 20CCEL703 SDG NO.8,9 | QUANTUM COMPUTING | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To introduction to quantum computing
- To know the various quantum systems
- To know the Relationship between quantum and classical complexity classes
- To know the Deutsch's algorithm, Deutsch's-Jozsa algorithm, Shor factorization, Grover search
- To find the evaluation of the Noise and error correction

UNIT I INTRODUCTION TO QUANTUM COMPUTING**9**

Overview of traditional computing – Church-Turing thesis – circuit model of computation – reversible computation – quantum physics – quantum physics and computation – Dirac notation and Hilbert Spaces – dual vectors – operators – the spectral theorem – functions of operators – tensor products – Schmidt decomposition theorem.

UNIT II QUBITS AND QUANTUM MODEL OF COMPUTATION**9**

State of a quantum system – time evolution of a closed system – composite systems – measurement – mixed states and general quantum operations – quantum circuit model – quantum gates – universal sets of quantum gates – unitary transformations – quantum circuits.

UNIT III QUANTUM STANDARD ALGORITHMS - I 9

Superdense coding – quantum teleportation – applications of teleportation – probabilistic versus quantum algorithms – phase kick-back – the Deutsch algorithm – the Deutsch- Jozsa algorithm – Simon's algorithm – Quantum phase estimation and quantum Fourier Transform – eigenvalue estimation.

UNIT IV QUANTUM STANDARD ALGORITHMS - II 9

Order-finding problem – eigenvalue estimation approach to order finding – Shor's algorithm for order finding – finding discrete logarithms – hidden subgroups – Grover's quantum search algorithm – amplitude amplification – quantum amplitude estimation – quantum counting – searching without knowing the success probability

UNIT V QUANTUM COMPUTATIONAL COMPLEXITY AND ERROR CORRECTION 9

Computational complexity – black-box model – lower bounds for searching – general black-box lower bounds – polynomial method – block sensitivity – adversary methods – classical error correction – classical three-bit code – fault tolerance – quantum error correction – three- and nine-qubit quantum codes – fault-tolerant quantum computation

TOTAL: 45 PERIODS**TEXT BOOKS:**

1. P. Kaye, R. Laflamme, and M. Mosca, "An introduction to Quantum Computing", Oxford University Press, 1999.

REFERENCES:

1. Nielsen M. A., Quantum Computation and Quantum Information Cambridge University Press.
2. V. Sahni, "Quantum Computing", Tata McGraw-Hill Publishing Company, 2007.
3. Benenti G., Casati G. and Strini G., Principles of Quantum Computation and Information, Vol. I: Basic Concepts, Vol II: Basic Tools and Special Topics, WorldScientific.

WEB REFERENCES

1. https://www.udemy.com/course/quantumcomputingquantumphysics/?utm_source=adwords&utm_medium=udemyads&utm_

ONLINE RESOURCES:

1. https://www.youtube.com/watch?v=Z1uoz_8dLH0&list=PL74Rel4IAsETUwZS_Se_P-fSEyEVQwni7

2. <https://www.youtube.com/playlist?list=PLq-Gm0yRYwThGmlypvSFQ-kT2rPaXKAZ5>

OUTCOMES:

1. Describe about quantum computing basics (K1)
2. Design the model for quantum computing systems (K3)
3. Design the algorithm for the model for quantum computing system (K3)
4. Develop the advanced algorithm for the progressed model (K3)
5. Compare Different Quantum Standard Algorithms (K3)
5. Compute the computational complexity and correct the errors (K3)

CO- PO, PSO MAPPING :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| C01 | 3 | 3 | 3 | 2 | 3 | 1 | 1 | _ | 1 | 3 | 2 | 1 | 2 | 3 |
| C02 | 3 | 3 | 3 | 2 | 3 | 1 | 1 | _ | 1 | 3 | 2 | 1 | 2 | 3 |
| C03 | 3 | 3 | 3 | 2 | 3 | 1 | 1 | _ | 1 | 3 | 2 | 1 | 2 | 3 |
| C04 | 3 | 3 | 3 | 2 | 3 | 1 | 1 | _ | 1 | 3 | 2 | 1 | 2 | 3 |
| C05 | 3 | 3 | 3 | 2 | 3 | 1 | 1 | _ | 1 | 3 | 2 | 1 | 2 | 3 |
| C06 | 3 | 3 | 3 | 2 | 3 | 1 | 1 | _ | 1 | 3 | 2 | 1 | 2 | 3 |

PROFESSIONAL ELECTIVE III

| | | | | | |
|----------------------------|-----------------------|---|---|---|---|
| 20ECPC702 SDG NO. 9, 11 | OPTICAL COMMUNICATION | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To study about the various optical fiber modes, configuration and transmission characteristics of optical fibers
- To learn about the transmission characteristics associated with dispersion and polarization techniques
- To learn about the various optical sources, detectors and transmission techniques
- To explore various idea about optical fiber measurements and various coupling techniques
- To enrich the knowledge about optical communication systems and networks

UNIT I INTRODUCTION TO OPTICAL FIBERS 9

Introduction, need for optical communication, salient features of optical fibers, Ray theory of light guidance, Basic optical laws and definitions, Total internal reflection, Acceptance angle, Numerical aperture, Modes of a fiber, single and multimode fibers, Step-index and graded-index fibers, Fiber fabrication techniques. Electromagnetic nature of light, Boundary Conditions, Reflection and transmission of waves at a boundary, Modal analysis of optical fibers, Linearly polarized modes.

UNIT II SIGNAL DEGRADATION IN OPTICAL FIBER 9

Attenuation, Absorption, Scattering losses, Bending losses, Core and Cladding losses, Signal dispersion, Inter symbol interference and bandwidth, Intra model dispersion, Material dispersion, Waveguide dispersion, Polarization mode dispersion, Intermodal dispersion. Pulse broadening In GI fibers, Mode Coupling, Design optimization of single mode fiber, Characteristics of single mode fiber, RI Profile cutoff wave length, Dispersion calculations, Mode field diameter.

UNIT III OPTICAL SOURCES AND DETECTORS 9

Sources and Deectors: Intrinsic and extrinsic materials, Direct and indirect band gaps, LED structures, Surface emitting LED, Edge emitting LED, Quantum efficiency and LED power, Light source materials, Modulation of LED, LASER diodes, Modes and threshold conditions, Rate equations, External quantum efficiency. PIN photo detector, Avalanche photo diodes, Photo detector noise, Noise sources, SNR, Detector response time, Avalanche multiplication noise.

UNIT IV OPTICAL RECEIVER, MEASUREMENTS AND COUPLING 9

Fundamental receiver operation, preamplifiers, error sources, Front end amplifiers, Digital receiver performance, Probability of error, Receiver sensitivity, Quantum limit. Optical power measurement, Attenuation measurement (Cut back & Insertion loss Methods), Dispersion measurement, Fiber Numerical Aperture Measurements, Fiber cut-off Wave length Measurements, Fiber diameter measurements, OTDR Field Applications: OTDR Trace-Attenuation Measurements and Fiber fault location.

Coupling: Source to Fiber Power Launching, Lensing Schemes for coupling improvement, Fiber-to-Fiber Joints, LED Coupling to Single mode Fibers-Fiber Splicing, Optical Connectors.

UNIT V OPTICAL COMMUNICATION SYSTEMS AND NETWORKS 9

Digital Transmission Systems, System design consideration, Point-to-Point links, Link power budget, Rise time budget, WDM Concepts and Components, Elements of optical networks, SONET/SDH, Optical Interfaces, SONET/SDH

Rings and Networks, Broadcast and select WDM Networks, Wavelength Routed Networks, Optical ETHERNET, Solitons, All-Optical Networking, Evolution, Benefits, Challenges, and Future Vision.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Gred Keiser, "Optical Fiber Communication", McGraw Hill Education (India) Private Limited, Fifth Edition, Reprint 2013.
2. John M. Senior, "Optical Fiber Communication", Pearson Education, Second Edition, 2007.

REFERENCES:

1. Rajiv Ramaswami, "Optical Networks", Second Edition, Elsevier, 2004.
2. J.Gower, "Optical Communication System", Prentice Hall of India, 2001.
3. Govind P. Agrawal, "Fiber Optic Communication Systems", Third Edition, John Wiley & sons, 2004.

WEB REFERENCES:

1. <https://ieeexplore.ieee.org/abstract/document/6166843>

ONLINE REFERENCES

1. https://onlinecourses.nptel.ac.in/noc18_ph06

OUTCOMES:

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

1. Realize basic elements in optical fibers, different modes and configurations. (K2)
2. Analyze the transmission characteristics associated with dispersion and polarization techniques. (K2)
3. Discuss optical sources, detectors, with their use in optical communication system. (K2)
4. Construct fiber optic receiver systems, and coupling techniques. (K3)
5. Measure Optical fiber parameters and performance (K2)
6. Design optical communication systems and its networks. (K3)

CO- PO, PSO MAPPING :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | - | - | - | - | 2 | 2 | 1 |
| CO2 | 3 | 3 | 2 | 2 | 3 | 1 | - | - | - | - | - | 2 | 2 | 1 |
| CO3 | 3 | 3 | 3 | 1 | 2 | - | 1 | - | - | - | - | - | 2 | 1 |
| CO4 | 3 | 3 | 3 | 1 | 2 | - | - | - | 1 | 1 | - | - | 2 | 1 |
| CO5 | 3 | 2 | 2 | 1 | 1 | 1 | - | - | - | - | - | - | 2 | 1 |
| CO6 | 2 | 1 | - | - | - | - | 2 | 1 | - | - | - | - | 2 | 1 |

PROFESSIONAL ELECTIVE III

| | | | | | |
|-------------------------------------|--------------------------------------|----------|----------|----------|----------|
| 20CCEL704 SDG NO.4 | DATABASE SECURITY AND PRIVACY | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To understand the fundamentals of security, and how it relates to information systems.
- To identify risks and vulnerabilities in operating systems from a database perspective.
- To learn good password policies, and techniques to secure passwords in an organization.
- To learn and implement administration policies for users.
- To understand the various database security models and their advantages or disadvantages.
- To learn to implement privacy preserving data mining algorithms.

UNIT I OPERATING SYSTEM SECURITY FUNDAMENTALS 9

Introduction-Information Systems- Database Management Systems- Information Security Architecture- Database Security–Asset Types and value- Security Methods. Introduction-Operating System Overview-Security . Environment – Components- Authentication Methods-User Administration- Password Policies-Vulnerabilities-E- mail Security.

UNIT II ADMINISTRATION OF USERS, POLICIES, PRIVILEGES AND ROLES 9

Introduction-Authentication-Creating Users, SQL Server User-Removing,

Modifying Users-Default, Remote Users-Database Links-Linked Servers-Remote Servers-Practices for Administrators and Managers-Best Practices Profiles, Password Policies, Introduction-Defining and Using Profiles-Designing and Implementing Password . Policies-Granting and Revoking User Privileges-Creating, Assigning and Revoking User Roles-Best Practices.

UNIT III DATABASE APPLICATION SECURITY MODELS AND PRIVATE DATABASES 9

Introduction- Types of Users-Security Models- Application Types- Application Security Models-Data Encryption. Introduction-Overview of VPD-Implementation of VPD using Views, Application Context in Oracle-Implementing Oracle VPD-Viewing VPD Policies and Application contexts using Data Dictionary, Policy Manager Implementing Row and Column level Security with SQL Server.

UNIT IV- AUDITING DATABASE ACTIVITIES 9

Using Oracle Database Activities-Creating DLL Triggers with Oracle- Auditing Database Activities with Oracle-Auditing Server Activity with SQL Server 2000-Security and Auditing Project Case Study.

UNIT V - PRIVACY PRESERVING DATA MINING TECHNIQUES 9

Privacy Preserving Data Mining Techniques: Introduction- Privacy Preserving Data Mining Algorithms- General Survey-Randomization Methods-Group Based Anonymization-Distributed Privacy Preserving Data Mining-Curse of Dimensionality-Application of Privacy Preserving Data Mining

TOTAL : 45 PERIODS

TEXT BOOK

1. Hassan A. Afyouni, "Database Security and Auditing", Third Edition, Cengage Learning, 2009.(UNIT 1 to IV)
2. Charu C. Aggarwal, Philip S Yu, "Privacy Preserving Data Mining": Models and Algorithms, Kluwer Academic Publishers, 2008.(UNIT V).

REFERENCE

1. Ron Ben Natan, "Implementing Database Security and Auditing", Elsevier Digital Press, 2005.

ONLINE RESOURCES:

1. <http://charuaggarwal.net/toc.pdf>
2. <http://adrem.ua.ac.be/sites/adrem.ua.ac.be/files/securitybook.pdf>

OUTCOMES:

1. Describe Operating System Security Fundamentals (K1)
2. Illustrate Administration of Users and Different Policies (K2)
3. Illustrate the use of Database Security Models (K3)
4. Interpret the Concepts of VPD (K3)
5. Auditing Database Activities (K2)
6. Apply privacy preserving data mining algorithms.(K3)

CO- PO, PSO MAPPING :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| C01 | 3 | 2 | 2 | 2 | 1 | 2 | - | - | - | - | 1 | 2 | 3 | 2 |
| C02 | 3 | 2 | 3 | 2 | 1 | 2 | - | - | - | - | 1 | 2 | 3 | 2 |
| C03 | 3 | 2 | 3 | 2 | 1 | 2 | - | - | - | - | 1 | 2 | 3 | 2 |
| C04 | 3 | 2 | 3 | 2 | 1 | 2 | - | - | - | - | 1 | 2 | 3 | 2 |
| C05 | 3 | 2 | 3 | 2 | 1 | 2 | - | - | 2 | 3 | 1 | 2 | 3 | 2 |
| C06 | 3 | 2 | 3 | 2 | 1 | 2 | - | - | 2 | 3 | 1 | 2 | 3 | 2 |

PROFESSIONAL ELECTIVE III

| | | | | | |
|-------------------------------------|---|----------|----------|----------|----------|
| 20CCEL705 SDG NO.4 | PARALLEL ARCHITECTURE AND ALGORITHMS | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To understand different parallel architectures and models of computation.
- To introduce the various classes of parallel algorithms.
- To study parallel algorithms for basic problems.

UNIT I INTRODUCTION**9**

Need for Parallel Processing - Data and Temporal Parallelism - Models of Computation - RAM and PRAM Model – Shared Memory and Message Passing Models- Processor Organisations - PRAM Algorithm – Analysis of PRAM Algorithms- Parallel Programming Languages.

UNIT II PRAMALGORITHMS**9**

Parallel Algorithms for Reduction – Prefix Sum – List Ranking –Preorder Tree Traversal – Searching -Sorting - Merging Two Sorted Lists – Matrix Multiplication - Graph Coloring – Graph Searching.

UNIT III SIMD ALGORITHMS-I**9**

2D Mesh SIMD Model - Parallel Algorithms for Reduction - Prefix Computation - Selection - Odd-Even Merge Sorting - Matrix Multiplication.

UNIT IV SIMD ALGORITHMS-II**9**

Hypercube SIMD Model - Parallel Algorithms for Selection- Odd-Even Merge Sort- Bitonic Sort- Matrix Multiplication Shuffle Exchange SIMD Model - Parallel Algorithms for Reduction -Bitonic Merge Sort - Matrix Multiplication - Minimum Cost Spanning Tree.

UNIT V MIMD ALGORITHMS**9**

UMA Multiprocessor Model -Parallel Summing on Multiprocessor- Matrix Multiplication on Multiprocessors and Multicomputer - Parallel Quick Sort - Mapping Data to Processors.

TOTAL: 45 PERIODS**TEXT BOOKS:**

1. Michael J. Quinn, "Parallel Computing : Theory & Practice", Tata McGraw Hill Edition, Second edition, 2017.
2. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms", University press, Second edition, 2011.
3. V Rajaraman, C Siva Ram Murthy, " Parallel computers- Architecture and Programming", PHI learning, 2016.

REFERENCES:

1. Ananth Grame, George Karpis, Vipin Kumar and Anshul Gupta, "Introduction to Parallel Computing", 2nd Edition, Addison Wesley, 2003.
2. M Sasikumar, Dinesh Shikhare and P Ravi Prakash , " Introduction to Parallel Processing", PHI learning, 2013.
3. S.G.Akl, "The Design and Analysis of Parallel Algorithms", PHI, 1989.

WEB REFERENCES:

1. <https://web.cs.ucdavis.edu/~amenta/s13/parallel.html>
2. <https://www.sciencedirect.com/topics/computer-science/parallel-architectures>.

ONLINE RESOURCES:

1. <https://freevidelectures.com/course/3361/parallel-algorithm>
2. <https://www.classcentral.com/course/swayam-parallel-algorithms-12934>
3. <https://nptel.ac.in/courses/106106112/>

OUTCOMES:

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

1. Introduce to parallel algorithms
2. Introduction of various classes of parallel Algorithms
3. Develop Parallel algorithms for standard problems
4. Understanding and applications of Parallel Algorithm
5. Analyze efficiency of different parallel algorithms.

CO- PO, PSO MAPPING :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| C01 | 3 | 3 | 3 | - | - | 1 | - | - | - | - | - | 1 | 3 | 2 |
| C02 | 3 | 3 | 3 | 1 | - | 2 | - | - | - | - | - | 2 | 3 | 2 |
| C03 | 3 | 3 | 3 | - | - | 1 | - | - | - | - | - | 1 | 3 | 2 |
| C04 | 3 | 3 | 3 | - | - | 2 | - | - | - | - | - | 1 | 3 | 2 |
| C05 | 3 | 3 | 3 | 1 | - | 2 | - | - | 2 | - | 2 | 1 | 3 | 2 |
| C06 | 3 | 3 | 3 | - | - | 2 | - | - | - | - | - | 1 | 3 | 2 |

PROFESSIONAL ELECTIVE III

| | | | | | |
|-------------------------------------|------------------------|----------|----------|----------|----------|
| 20CCPC602 SDG NO.4 | COMPILER DESIGN | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To learn about the various phases of the Compiler
- To learn various Parsing techniques
- To understand Intermediate code generation & run time environment
- To analyze Code optimization techniques & Code generation algorithm

UNIT I INTRODUCTION TO COMPILERS**9**

Translators-Compilation and Interpretation-Language processors – Analysis of the source program – Phases of a compiler – Cousins of the Compiler – Grouping of Phases – Compiler construction tools – Lexical Analysis – Role of Lexical Analyzer – Input Buffering – Specification of Tokens– Recognition of Tokens – LEX tool–Regular Expressions to Automata Direct method.

UNIT II SYNTAX ANALYSIS**12**

Role of the parser – Writing a Grammar – Context-Free Grammars – Top Down parsing – Recursive Descent Parsing – Predictive LL(1) Parsing – Bottom-up parsing – Shift Reduce Parsing – Operator Precedence Parsing – LR Parsers – SLR Parser – Introduction to LALR & CLR Parser - Error Handling and Recovery in Syntax Analyzer-YACC.

UNIT III INTERMEDIATE CODE GENERATION**8**

Intermediate languages – Declarations – Assignment Statements – Boolean Expressions – Case Statements – BackPatching – Procedure calls. Type Systems-Specification of a simple type checker- Equivalence of Type Expressions-Type Conversions.

UNIT IV RUN-TIME ENVIRONMENT AND CODE GENERATION**8**

Source Language Issues-Storage Organization-Storage Allocation-Parameter Passing-Symbol Tables- Dynamic Storage Allocation. Issues in the design of code generator – The target machine - Basic Blocks and Flow Graphs – Next-use Information – A simple Code generator – DAG Representation of Basic Blocks.

UNIT V CODE OPTIMIZATION**8**

Principal Sources of Optimization – Peep-hole optimization - DAG-Optimization of Basic Blocks- Global Data Flow Analysis - Efficient Data Flow Algorithm.

TOTAL: 45 PERIODS**TEXT BOOKS:**

1. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, "Compilers: Principles, Techniques and Tools", Second Edition, Pearson Education, 2009.
2. V. Raghavan, "Principles of Compiler Design", Tata McGraw Hill Education Publishers, 2010.

REFERENCES:

1. Randy Allen, Ken Kennedy, "Optimizing Compilers for Modern Architectures: A Dependence based Approach", Morgan Kaufmann Publishers, 2002.
2. Steven S. Muchnick, "Advanced Compiler Design and Implementation", Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint 2003
3. Keith D Cooper and Linda Torczon, "Engineering a Compiler", Morgan Kaufmann Publishers Elsevier Science, 2004.

- Allen I. Holub, "Compiler Design in C", Prentice-Hall Software Series, 1993.
- Charles N. Fischer, Richard. J. LeBlanc, "Crafting a Compiler with C", 2008.

WEB REFERENCES:

- <http://www.holub.com/software/compiler.design.in.c.docs.pdf>
- <http://www.cs.usfca.edu/~galles/compilerdesign/x86.pdf>

ONLINE RESOURCES:

- <https://www.javatpoint.com/compiler-tutorial>

OUTCOMES:

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

- Explain the role of each phase of a compiler with its construction tools.(K2)
- Illustrate the role of a Lexical Analyzer for recognizing the tokens of a given language with the knowledge of symbol table management and error-handling (K3)
- Construct parsers like top-down, bottom-up for a given grammar (K3)
- Develop semantic analyzers for type-checking and intermediate code generators to translate the source program into an intermediate code (K3)
- Outline Runtime environment and a simple Code Generator using the code generation Algorithm (K2)
- Implement code optimizers to optimize the target code generated (K3)

CO- PO, PSO MAPPING:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| C01 | 3 | - | - | - | - | - | - | - | - | - | - | - | 2 | 2 |
| C02 | 3 | 2 | - | 1 | 2 | - | - | - | - | - | - | 1 | 2 | 2 |
| C03 | 2 | 3 | - | 2 | - | - | - | - | - | - | - | 1 | 2 | 2 |
| C04 | 2 | 3 | 1 | 2 | - | - | - | - | - | - | - | 1 | 2 | 2 |
| C05 | 3 | 2 | - | - | - | - | - | - | - | - | - | 1 | 2 | 2 |
| C06 | 1 | - | 3 | - | 1 | - | - | - | - | - | - | 1 | 2 | 2 |

PROFESSIONAL ELECTIVES - III

| | | | | | |
|-----------------------------------|--------------------------------------|----------|----------|----------|----------|
| 20ITEL710 SDG NO. 4 & 9 | SERVICE ORIENTED ARCHITECTURE | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To understand the basic principles of Service Oriented Architecture
- To learn the fundamentals of XML
- To implement API using XML, JSON and REST
- To study about web services technology elements of SOA

UNIT I INTRODUCTION TO XML AND XML BASED APPLICATIONS 9

XML Document Structure – Well Formed and Valid documents – Name Spaces – DTD – XML Schema – X-Files - Parsing XML using DOM - SAX – XML Transformation and XSL – XSL Formatting – Modeling Databases in XML.

UNIT II DESIGN OF API USING JSON AND REST 9

Introduction to JSON - REST- Comparison of XML , JSON and REST - HTTP Methods using RESTful Services - REST Architectural Constraints - Richardson Maturity Model - JSON and REST Based Service Provider and Requestor API Examples.

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 WEBSERVICES 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

TEXT BOOKS:

1. Ron Schmelzer et al. “XML and Web Services”, Pearson Education, 2002
2. Thomas Erl, “Service Oriented Architecture: Concepts, Technology, and Design”, Pearson Education, 2005.

REFERENCES:

1. Frank P.Coyle, "XML, Web Services and the Data Revolution", Pearson Education,2002.
2. Eric Newcomer, GregLomow, "Understanding SOA with Web Services", Pearson Education, 2005.
3. Sandeep Chatterjee and James Webber, "Developing Enterprise Web Services: An Architect's Guide", Prentice Hall, 20044.
4. James McGovern, Sameer Tyagi, Michael E.Stevens, Sunil Mathew, "Java Web.Services Architecture", Morgan Kaufmann Publishers,2003.
5. Thomas Erl,"Service-oriented Architecture: Concepts, Technology, and Design",2016

WEB REFERENCES:

1. <https://www.coursera.org/learn/service-oriented-arhitecture>
2. <https://restfulapi.net/json-schema/>
3. https://www.w3schools.com/js/js_json_intro.asp

ONLINE RESOURCES:

1. https://nptel.ac.in/conten/storage2/nptel_data3/html/mhrd/ict/text/106105167/lec10.pdf

OUTCOMES:**Upon completion of the course, the student should be able to**

1. Demonstrate the basic concepts of XML and XML based applications. (K3)
2. Construct the design of API using JSON & REST. (K3)
3. Discuss the basics concepts of SOA, its Principles and Benefits. (K2)
4. Interpret the Web services using technology elements. (K2)
5. Analyse the SOA based applications for intra-enterprise and inter-enterprise applications. (K4)

CO- PO, PSO MAPPING :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| C01 | 2 | 2 | - | 1 | - | - | - | - | 1 | - | 1 | 1 | 1 | 2 |
| C02 | 3 | 3 | - | 1 | 1 | - | - | - | 1 | 1 | 1 | 2 | 1 | 2 |
| C03 | 3 | 2 | - | - | - | - | - | - | - | - | - | 1 | - | 1 |
| C04 | 3 | 3 | 1 | - | - | - | - | - | - | 1 | 1 | 1 | 1 | 1 |
| C05 | 3 | 3 | 1 | 1 | 1 | - | - | - | 1 | 1 | 1 | 2 | 1 | 2 |

PROFESSIONAL ELECTIVE III

| | | | | | |
|------------------------------|--|----------|----------|----------|----------|
| 20CCEL706 SDG NO.4 | ADVANCED WIRELESS COMMUNICATION | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To learn the latest concepts of wireless communication.
- To understand propagation models and its design parameters.
- To learn various modulation techniques and fading concepts
- To enable understanding of channel impairment mitigation using space time block and Trellis codes
- To practice and implement possible techniques to improve the performance of wireless systems.

UNIT I INTRODUCTION

9

Introduction about wireless communication - technical challenges of wireless communication- applications; Cellular architecture - frequency reuse - channel assignment - handoff - coverage and capacity improvement; Multiple access - FDMA/CDMA/TDMA/SDMA

UNIT II PROPAGATION PRINCIPLES

9

Propagation Principles: Propagation mechanisms - channel modeling methods - radio channels- indoor channels - outdoor channels - fading channels ; Mobile Radio Propagation : Large scale path loss – path loss and propagation models - small scale fading - types of small scale fading- parameters of mobile multipath channels - statistical models for multipath fading channel.

UNIT III MODULATION AND DETECTION

9

Digital modulation: Structure of a wireless communication link - linear and constant envelope modulation techniques for wireless communication - error performance in fading channel; Transmission System; combined fast and slow fading - Equalization - different detection techniques used in wireless communication.

UNIT IV MIMO SYSTEMS

9

Types of MIMO Systems: Beam forming - spatial multiplexing - basic space time code design principles- Alamouti scheme - orthogonal and quasi orthogonal space time block codes- space time trellis codes - representation of space - performance analysis for space-time trellis codes - comparison of space-time block and trellis codes.

UNIT V INSTRUCTIONAL ACTIVITIES**9**

Simulation of minimum of (2) modulation and multiple access techniques for wireless communication using related simulation tools.

TOTAL: 45 PERIODS**TEXT BOOKS:**

1. Andreas Molisch F, "Wireless Communications", John Wiley and Sons Ltd., 2011.
2. Andrea Goldsmith, "Wireless Communications", Cambridge University Press, 2005

REFERENCES:

1. David Tse and Pramod Viswanath, "Fundamentals of Wireless Communication", Cambridge University Press, 2005.
2. Theodore S. Rappaport, "Wireless Communications: Principles and Practice", 2nd Edition, Prentice Hall of India, 2005.
3. Guillaume De La Roche, Andres Alayon Glazunov and Ben Allen, "LTE – Advanced and Next Generation Wireless Networks: Channel Modelling and Propagation", John Wiley and Sons Ltd., 2013
4. S.G. Glisic, "Advanced Wireless Communications", 4G Technologies, Wiley, 2004
5. Michel Daoud Yacoub, "Wireless Technology: Protocols, Standards, and Techniques", CRC Press, 2002.
6. Jafarkhani H, "Space-Time Coding: Theory & Practice", Cambridge University Press, 2005.

WEB REFERENCES:

1. <http://ee.sharif.edu/~wireless.comm.net/references/Tse,%20Fundamentals%20of%20Wireless%20Communication.pdf>
2. <http://ee.sharif.edu/~pr.wireless.comm/references/Goldsmith.pdf>

ONLINE RESOURCES:

1. <https://saravanyablog.files.wordpress.com/2017/04/andreas-f-molisch-wireless-comm.pdf>
2. <http://freevideolectures.com/Course/2329/Wireless-Communication>
3. <https://videoken.com/search-results>

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

- 1 Discuss cellular system design and technical challenges. (K1)
- 2 Analyze the Mobile radio propagation, fading, path loss and the channel modelling.(K3)
- 3 Evaluate the performance of digital modulation techniques over wireless channels using software and hardware techniques. (K3)
- 4 Analyze the design parameters, link design, smart antenna, beam forming and MIMO systems.(K3)
- 5 Suggest the possible techniques to improve the performance of wireless systems using modern tools. (K2)
- 6 Describe the various Instructional Activities (K2)

CO- PO, PSO MAPPING :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| C01 | 2 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 |
| C02 | 3 | 2 | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 1 | 3 | 2 | 2 | 2 |
| C03 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 2 | 2 | 2 | 3 | 2 |
| C04 | 3 | 2 | 3 | 3 | 3 | 2 | 2 | 3 | 1 | 2 | 2 | 2 | 3 | 3 |
| C05 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 1 | 3 | 2 | 2 | 3 |
| C06 | 3 | 2 | 3 | 3 | 3 | 2 | 2 | 3 | 1 | 2 | 2 | 2 | 3 | 3 |

PROFESSIONAL ELECTIVE III

| | | | | | |
|-------------------------------------|---------------------------------|----------|----------|----------|----------|
| 20CCEL707 SDG NO.4 | PRINCIPLES OF MULTIMEDIA | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To provide sound knowledge in scripting languages, user interface design, and efficient program development
- To create exciting, compelling interactive user experiences.

UNIT I INTRODUCTION 9

Introduction to Multimedia – Characteristics – Utilities – Creation -Uses – Promotion – Digital Representation – Media and Data streams – Multimedia Architecture – Multimedia Documents

UNIT II ELEMENTS OF MULTIMEDIA 9

Text: types – font - Unicode standard - text compression - file formats. – Image: types - image processing – standards - specification - device independent color models - gamma correction - file formats – Video :video signal transmission - signal formats - broadcasting standards - digital video standards - PC video - video file formats – Audio : acoustics - characteristics of sound - elements of audio system – microphone – amplifier – loudspeaker - audio mixer - digital audio - MIDI – Graphics – components of graphics system, co-ordinate system – plotter - Intro to 2D & 3D Graphics -surface characteristics and texture - lights – Animation :key frames & Tweening, techniques, principles of animation, 3D animation, file formats.

UNIT III MULTIMEDIA SYSTEMS 9

Visual Display Systems – CRT - video adapter card - video adapter cable – LCD – PDP - optical storage media - CD technology - DVD Technology - Compression Types and Techniques – CODEC - GIF coding standards - lossy and lossless – JPEG - MPEG-1 - MPEG-2 - MP3 - Fractals – MMDBS

UNIT IV MULTIMEDIA TOOLS 9

Authoring tools – features and types - card and page based tools - icon and object based tools - time based tools - cross platform authoring tools - Editing tools - text editing and word processing tools - OCR software - painting and drawing tools - 3D modeling and animation tools - image editing tools -sound editing tools - digital movie tools – plug -ins and delivery vehicles for www

UNIT V MULTIMEDIA APPLICATION DEVELOPMENT**9**

Software life cycle – ADDIE Model – conceptualization – content collection and processing – story – flowline – script - storyboard - implementation - multiplatform issues – authoring – metaphors – testing – report writing - documentation - case study: -Web Application – Console Application – Distributed Application – Mobile Application - games consoles – iTV – kiosks – education

TOTAL : 45 PERIODS**TEXT BOOKS:**

1. Parekh R “Principles Of Multimedia” Tata McGraw-Hill, 2006.
2. Ralf Steinmetz, Klara Nahrstedt, “Multimedia: Computing, Communications and Applications” Prentice Hall, 1995.

REFERENCES:

1. Tay Vaughan, “Multimedia: Making It Work” McGraw-Hill Professional, 2006
2. Deitel & Deitel “Internet & World Wide Web How to Program”, Fourth Edition – Prentice Hall, 2008.

OUTCOME:**At the end of this course, the student will be able to**

1. Understand the basic concepts of multimedia characteristics, media and data streams (K2)
2. Implement the concepts of multimedia architecture and multimedia documents (K3)
3. Learn the concepts of text, image and video types (K2)
4. Analyze signal formats and digital video standards (K3)
5. Acquire the concepts of visual display systems such as CRT, LCD, and PDP (K2)
6. Summarize the Various Multimedia application Development (K2)

CO- PO, PSO MAPPING :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| C01 | 2 | 1 | 2 | 1 | 1 | 1 | - | - | - | - | - | 2 | 2 | 1 |
| C02 | 3 | 2 | 2 | 2 | 2 | 1 | - | - | - | - | - | 1 | 2 | 1 |
| C03 | 3 | 2 | 3 | 3 | 3 | 2 | - | - | - | - | - | 1 | 2 | 2 |
| C04 | 3 | 2 | 3 | 3 | 3 | 2 | - | - | - | - | - | 1 | 2 | 2 |
| C05 | 3 | 3 | 3 | 3 | 3 | 2 | - | - | - | - | - | 1 | 2 | 1 |
| C06 | 3 | 3 | 3 | 3 | 3 | 1 | - | - | - | - | - | 1 | 2 | 2 |

PROFESSIONAL ELECTIVE IV

| | | | | | |
|-----------------------|----------------------------|---|---|---|---|
| 20CCEL801 SDG NO.4 | HARDWARE SOFTWARE CODESIGN | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- Transform software programs into cycle-based hardware descriptions.
- Partition and implement software programs into hardware and software components and design interfaces to communicate between them.
- Explain the control-flow and data-flow of a software program and cycle accurate hardware components.

UNIT I INTRODUCTION TO HARDWARE SOFTWARE CODESIGN 9

Levels of Abstraction, Driving factors incodesign. Data flow modeling and implementation, Synchronous Data Flow Graphs,Scheduling of Data Flow, dynamic and static schedule. Pipelining, multi-rate expansion.

UNIT II TRANSFORMATION OF SOFTWARE INTO HARDWARE 9

Data and control flow of programs,construction of control flow graph. Design of data path and controller. Finite State Machinewith Data path, FSM modeling and implementation, Simulation and Synthesis of FSM.

UNIT III DESIGN OF CUSTOM ARCHITECTURES 9

Programming in Gezel. FSM examples in Gezel,Verilog, VHDL. Limitations of Finite state machines, Microprogrammed architecturecontrol, encoding, datapath. Microprogrammed Interpreters and pipelining. Picoblaze: Acontemporary microprogram controller. Embedded Cores for Codesign: Processors, RISCpipeline, Control, data and structural hazards.

UNIT IV PROGRAM ORGANIZATION 9

Data types, memory hierarchy, program layout, object code,compiled code. System On Chip: Design principles of SoC architecture. Data processing,Communications, Storage and Control of Heterogeneous and Distributed systems. Interfacingfor Hardware Software Codesign: on-chip bus systems, bus transfers, bus priority andlocking.

UNIT V SYNCHRONIZATION SCHEMES 9

semaphore, handshake, blocking and non-blocking datatransfer. Memory-Mapped Interfaces: Register, Mailbox, FIFO, Shared memory. CoprocessorInterfacing: tight and loose coupling, Fast Simplex Link, Custom

instruction interfaces, ASIP Design flow. Coprocessor design for Advanced Encryption Standard (AES): functions of coprocessor, Data and Control design, Programmers model, software design.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Patrick Schaumont, "A Practical Introduction to Hardware/Software Codesign", Springer, 2nd Edition, 2012.
2. D. D. Gajski, S. Abdi, A. Gerstlauer, G. Schirner, "Embedded System Design: Modeling, Synthesis and Verification", Springer, 2009.
3. P. Marwedel, "Embedded System Design: Embedded systems foundations of CyberPhysical Systems, Springer, 2011.
4. Frank Vahid, Tony Givargis, "Embedded System Design: A Unified Hardware/Software Introduction", John Wiley & Sons, 2002.

REFERENCE BOOKS

1. G. De Micheli, R. Ernst, W. Wolf, "Readings in Hardware/Software Codesign", Morgan Kaufman, 2002.
2. J. Staunstrup and Wayne Wolf, "Hardware/Software Co-design: Principles and practice", Springer, 1997.
3. Wayne Wolf, Computers as Components: Principles of Embedded Computing System Design, Elsevier Publication, 2nd Edition, 2008.

OUTCOMES

Upon completing the course, the student should be able to

- 1 Understand various models of computation for embedded systems (K2)
- 2 Understand the architectural selection, partitioning, scheduling and communication for embedded systems (K2)
- 3 Apply the simulation, synthesis and verification for FPGA implementation (K2)
- 4 Realize the retargetable code generation through hardware implementation (K2)
- 5 Understand the Coprocessor Interfacing and ASIP Design flow (K2)
- 6 Understand the Concepts of various Synchronization Schemes (K2)

CO- PO, PSO MAPPING :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 2 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 |
| CO2 | 3 | 2 | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 1 | 3 | 2 | 2 | 2 |
| CO3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 2 | 2 | 2 | 3 | 2 |
| CO4 | 3 | 2 | 3 | 3 | 3 | 2 | 2 | 3 | 1 | 2 | 2 | 2 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 1 | 3 | 2 | 2 | 3 |
| CO6 | 3 | 2 | 3 | 3 | 3 | 2 | 2 | 3 | 1 | 2 | 2 | 2 | 3 | 3 |

PROFESSIONAL ELECTIVE IV

| | | | | | |
|---|--|----------|----------|----------|----------|
| 20CCEL802 SDG NO.3,4,9 | FUZZY LOGIC AND NEURAL NETWORKS | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To Impact knowledge on fuzzy logic and Artificial Neural Networks
- To Understand models of ANN
- To Use the fuzzy logic and neural network for application related to design and manufacture

UNIT I INTRODUCTION TO FUZZY LOGIC PRINCIPLES**9**

Basic concepts of fuzzy set theory – operations of fuzzy sets – properties of fuzzy sets – Crisp relations – Fuzzy relational equations – operations on fuzzy relations – fuzzy systems – propositional logic – Inference – Predicate Logic – Inference in predicate logic – fuzzy logic principles – fuzzy quantifiers – fuzzy inference – fuzzy rule based systems – fuzzification and defuzzification – types.

UNIT II ADVANCED FUZZY LOGIC APPLICATIONS**9**

Fuzzy logic controllers – principles – review of control systems theory – various industrial applications of FLC adaptive fuzzy systems – fuzzy decision making – Multiobjective decision making – fuzzy classification – means clustering – fuzzy pattern recognition – image processing applications – syntactic recognition – fuzzy optimization.

UNIT III INTRODUCTION TO ARTIFICIAL NEURAL NETWORKS 9

Fundamentals of neural networks – model of an artificial neuron – neural network architectures – Learning methods – Taxonomy of Neural network architectures – Standard back propagation algorithms – selection of various parameters – variations Applications of back propagation algorithms.

UNIT IV OTHER ANN ARCHITECTURES 9

Associative memory–exponential BAM–Associative memory for real coded pattern pairs–Applications adaptive resonance theory – introduction – ART 1 – ART2 – Applications – neural networks based on competition – Kohonen self organizing maps – learning vector quantization – counter propagation networks – applications.

UNIT V RECENT ADVANCES 9

Fundamentals of genetic algorithms – genetic modeling – hybrid systems – integration of fuzzy logic, neural networks and genetic algorithms – non-traditional optimization techniques like ant colony optimization – Particle swarm optimization and artificial immune systems – applications in health sector, design and manufacturing.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Rajasekaran. S.. Vijayalakshmi Pai. G.A. “Neural Networks, Fuzzy Logic and Genetic Algorithms”, Prentice Hall of India Private Limited, 2003
2. Timothy J. Ross, “Fuzzy logic with Engineering Applications”, McGraw Hill, 2017.
3. Zurada J.M. “Introduction to Artificial Neural Systems”, Jaico publishing house, 2016.

REFERENCES:

1. Klir.G, Yuan B B “Fuzzy sets and Fuzzy Logic Prentice Hall of India private limited, 1997.
2. Laurene Fausett, “Fundamentals of Neural Networks”, Prentice hall, 1992

WEB REFERENCES:

1. https://swayam.gov.in/nd1_noc20_ge09
2. <https://www.slideshare.net/sajidqaxi/fuzzy-logic-and-neural-networks>
3. <https://nptel.ac.in/courses/127105006/>

ONLINE RESOURCES:

1. <https://youtu.be/IZWTduVCrf8>
2. <https://www.slideshare.net/ehamzei/fuzzy-set>

OUTCOMES:**Upon completion of the course, the student should be able to:**

- 1 Understand the principles behind Fuzzy logic and artificial neural network.(K2)
- 2 Understand various fuzzy logic controllers, optimization techniques and Genetic algorithm(K2)
- 3 Apply ANN models and Fuzzy logic principles to industrial application (K3)
- 4 Apply optimization techniques in design and manufacturing field (K3)
- 5 Analyze the fuzzy logic techniques using image processing and pattern recognition field (K3)
- 6 Describe the fundamentals of Genetic Algorithms (K2)

CO- PO, PSO MAPPING:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 2 | 2 | 3 | 1 | 2 | 2 | - | - | - | 2 | 2 | 3 | 2 |
| CO2 | 3 | 2 | 3 | 2 | 1 | 2 | 1 | - | - | - | 2 | 2 | 3 | 2 |
| CO3 | 3 | 3 | 3 | 3 | 2 | 3 | - | - | - | - | 2 | 2 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 2 | 3 | 2 | 1 | - | - | - | 2 | 2 | 3 | 3 |
| CO5 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | - | 2 | 3 | 2 | 2 | 3 | 3 |
| CO6 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | - | 2 | 3 | 2 | 2 | 3 | 3 |

PROFESSIONAL ELECTIVE IV

| | | | | | |
|---------------------------------------|------------------------------------|----------|----------|----------|----------|
| 20CSPC702 SDG NO.4,7 | MACHINE LEARNING TECHNIQUES | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To understand the need for machine learning for various problem solving
- To study the various supervised, semi-supervised and unsupervised learning algorithms in machine learning
- To understand the latest trends in machine learning
- To design appropriate machine learning algorithms for problem solving

UNIT I INTRODUCTION**9**

Learning Problems – Perspectives and Issues – Concept Learning – Version Spaces and Candidate Eliminations – Inductive bias – Decision Tree learning – Representation – Algorithm – Heuristic Space Search.

UNIT II NEURAL NETWORKS AND GENETIC ALGORITHMS**9**

Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evaluation and Learning.

UNIT III BAYESIAN AND COMPUTATIONAL LEARNING**9**

Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm – Probability Learning – Sample Complexity – Finite and Infinite Hypothesis Spaces – Mistake Bound Model.

UNIT IV INSTANT BASED LEARNING**9**

K - Nearest Neighbour Learning – Locally weighted Regression – Radial Basis Functions – Case Based Learning.

UNIT V ADVANCED LEARNING**9**

Learning Sets of Rules – Sequential Covering Algorithm – Learning Rule Set – First Order Rules – Sets of First Order Rules – Induction on Inverted Deduction – Inverting Resolution – Analytical Learning – Perfect Domain Theories – Explanation Base Learning – FOCL Algorithm – Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning

TOTAL: 45 PERIODS**TEXT BOOK:**

1. Tom M. Mitchell, “Machine Learning”, McGraw-Hill Education (India) Private Limited, 2017.
2. Marco Gori , “Machine Learning: A Constraint-Based Approach”, Morgan Kaufmann. 2017

REFERENCES:

1. Ethem Alpaydin, “Introduction to Machine Learning (Adaptive Computation and Machine Learning)”, The MIT Press 2004.
2. Stephen Marsland, “Machine Learning: An Algorithmic Perspective”, CRC Press, 2009

3. Richard O. Duda, Peter E. Hart, David G. Stork, "Pattern Classification", Wiley, Second Edition.
4. Christopher Bishop, "Pattern Recognition and Machine Learning", illustrated Edition, Springer, 2006.
5. Peter Flach, "Machine Learning: The Art and Science of Algorithms that Make Sense of Data", First Edition, Cambridge University Press, 2012.

WEB REFERENCES:

1. <https://towardsdatascience.com/best-resources-for-ai-machine-learning-data-science-d72625d4689d>
2. <https://www.analyticsvidhya.com/resources-machine-learning-deep-learning-neural-networks/>
3. <https://www.ritchieng.com/machine-learning-resources/>
4. <https://www.guru99.com/machine-learning-tutorial.html>

OUTCOMES:**Upon completion of the course, the student should be able to**

1. Gain knowledge about basic concepts of Machine Learning and differentiate between supervised, unsupervised, semi-supervised machine learning approaches. (K2)
2. Discuss and apply the back propagation algorithm and genetic algorithms to various problems. (K2)
3. Discuss the Decision Tree algorithm, identify and overcome the problem of over fitting and apply the Bayesian concepts to Machine Learning. (K2)
4. Solve the problems using various Machine Learning techniques and apply instant based learning techniques. (K3)
5. Analyze and suggest appropriate Machine Learning approaches for various types of problems. (K4)
6. Demonstrate various machine learning algorithms in a range of real-world applications (K3)

CO- PO, PSO MAPPING :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PS01 | PS02 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| C01 | 3 | 3 | 3 | 3 | 3 | 2 | 1 | - | 3 | 3 | 2 | 2 | 3 | 2 |
| C02 | 3 | 3 | 3 | 3 | 3 | 2 | 1 | - | 3 | 3 | 2 | 2 | 3 | 2 |
| C03 | 3 | 3 | 3 | 3 | 3 | 2 | 1 | - | 3 | 3 | 2 | 2 | 3 | 2 |
| C04 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | - | 3 | 3 | 2 | 2 | 3 | 2 |
| C05 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | - | 3 | 3 | 2 | 2 | 3 | 2 |
| C06 | 2 | 2 | 2 | 1 | 2 | 1 | - | - | - | - | 1 | 2 | 2 | 2 |

PROFESSIONAL ELECTIVE IV

| | | | | | | | | |
|-------------------------------------|--------------------------------|--|--|--|----------|----------|----------|----------|
| 20ECEL803 SDG NO.4 | SATELLITE COMMUNICATION | | | | L | T | P | C |
| | | | | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- Understand the basics of satellite orbits
- Understand the satellite segment and earth segment
- Analyze the various methods of satellite access
- Understand the applications of satellites
- Understand the basics of satellite Networks

UNIT I SATELLITE ORBITS**9**

Kepler"s Laws, Newton"s law, orbital parameters, orbital perturbations, station keeping, geo stationary and non Geo-stationary orbits – Look Angle Determination- Limits of visibility – eclipse-Sub satellite point –Sun transit outage-Launching Procedures - launch vehicles and propulsion.

UNIT II SPACE SEGMENT**9**

Spacecraft Technology- Structure, Primary power, Attitude and Orbit control, Thermal control and Propulsion, communication Payload and supporting subsystems, Telemetry, Tracking and command-Transponders-The Antenna Subsystem.

UNIT III SATELLITE LINK DESIGN**9**

Basic link analysis, Interference analysis, Rain induced attenuation and interference, Ionospheric characteristics, Link Design with and without

frequency reuse.

UNIT IV SATELLITE ACCESS AND CODING METHODS

9

Modulation and Multiplexing: Voice, Data, Video, Analog – digital transmission system, Digital video Broadcast, multiple access: FDMA, TDMA, CDMA, DAMA Assignment Methods, compression – encryption, Coding Schemes.

UNIT V SATELLITE APPLICATIONS

9

INTELSAT Series, INSAT, VSAT, Mobile satellite services: GSM, GPS, INMARSAT, LEO, MEO, Satellite Navigational System. GPS Position Location Principles, Differential GPS, Direct Broadcast satellites (DBS/DTH).

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Dennis Roddy, "Satellite Communication", 4th Edition, Mc Graw Hill International, 2006.
2. Timothy, Pratt, Charles, W.Bostain, Jeremy E.Allnutt, "Satellite Communication", 2nd Edition, Wiley Publications, 2002

REFERENCES

1. Wilbur L.Pritchard, Hendri G. Suyderhoud, Robert A. Nelson, "Satellite Communication Systems Engineering", Prentice Hall/Pearson, 2007.
2. N.Agarwal, "Design of Geosynchronous Space Craft", Prentice Hall, 1986.
3. Bruce R. Elbert, "The Satellite Communication Applications", Hand Book, Artech House Boston London, 1997.
4. Tri T. Ha, "Digital Satellite Communication", II nd edition, 1990.
5. Emanuel Fthenakis, "Manual of Satellite Communications", Mc Graw Hill Book Co., 1984.
6. Robert G. Winch, "Telecommunication Trans Mission Systems", Mc Graw-Hill Book Co., 1983.
7. Brian Ackroyd, "World Satellite Communication and earth station Design", BSP professional Books, 1990.
8. G.B.Bleazard, "Introducing Satellite communications", NCC Publication, 1985.
9. M.Richharia, "Satellite Communication Systems-Design Principles", Macmillan 2003.

OUTCOMES:

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

- 1 Analyze the orbital mechanics (K2)
- 2 Classify different launch vehicles and describe the working of the space

segment subsystems. (K2)

- 3 Evaluate the satellite link budget and estimate the performance impairments. (K2)
- 4 Understand different earth station parameters and its measures. (K2)
- 5 Illustrate the different applications of satellites. (K2)
- 6 Illustrate the concepts of Satellite access and coding methods (K2)

CO- PO, PSO MAPPING :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 3 | 3 | 3 | 3 | 2 | 1 | - | 3 | 3 | 2 | 2 | 3 | 2 |
| CO2 | 3 | 3 | 3 | 3 | 3 | 2 | 1 | - | 3 | 3 | 2 | 2 | 3 | 2 |
| CO3 | 3 | 3 | 3 | 3 | 3 | 2 | 1 | - | 3 | 3 | 2 | 2 | 3 | 2 |
| CO4 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | - | 3 | 3 | 2 | 2 | 3 | 2 |
| CO5 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | - | 3 | 3 | 2 | 2 | 3 | 2 |
| CO6 | 2 | 2 | 2 | 1 | 2 | 1 | - | - | - | - | 1 | 2 | 2 | 2 |

PROFESSIONAL ELECTIVE IV

| | | | | | |
|-------------------------------------|--|----------|----------|----------|----------|
| 20CCEL803 SDG NO.4 | ETHICAL HACKING AND DIGITAL FORENSICS | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To learn how illegal computer attacks are performed and how to counteract them
- To explore the nature of digital evidence and to focus on the law issues surrounding computer crime.

UNIT I INTRODUCTION

9

Definition of hacking: Hacking windows – Network hacking – Web hacking – Password hacking. A study on various attacks – Input validation attacks –SQL injection attacks – Buffer overflow attacks - Privacy attacks.

UNIT II NETWORK FORENSICS

9

TCP / IP – Check sums – IP Spoofing port scanning, DNS Spoofing. Dos attacks – SYN attacks, Smurf attacks, UDP flooding, DDOS – Models. Firewalls – Packet filter firewalls, Packet Inspection firewalls – Application Proxy Firewalls.

Batch File Programming.

UNIT III FUNDAMENTALS OF COMPUTER FRAUD

9

Fundamentals of Computer Fraud: the use of computers in occupational fraud, Asset Misappropriation Cash Schemes Skimming, Cash larceny, Fraudulent disbursements – Threat concepts – Framework for predicting inside attacks – Managing the threat – Strategic Planning Process.

UNIT IV PREVENTION STRATEGIES

9

Architecture strategies for computer fraud prevention: Service oriented architecture, distributed system architecture, client server architecture – Protection of Web sites – Intrusion detection system: Active IDS, passive IDS – NIDS, HIDS: comparison of NIDS AND HIDS – Penetrating testing process – Web Services – Reducing transaction risks.

UNIT V FRAUD TAXONOMY

9

Key Fraud Indicator selection process customized taxonomies – Key fraud signature selection process – Accounting Forensics – Computer Forensics – Journaling and audit requirements – Standardized logging criteria – Journal risk and control matrix – Neural networks – Misuse detection and Novelty detection.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Kenneth C. Brancik “Insider Computer Fraud” Auerbach Publications Taylor & Francis Group – 2008.

REFERENCES

1. Ankit Fadia “Ethical Hacking” second edition Macmillan India Ltd, 2006

OUTCOME:

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

1. Evaluate penetration testing and ethical hacking of computer systems (K3)
2. Understand the role of the entire penetration testing process (K2)
3. Analyze and mitigate threats to internal computer systems (K3)
4. Process and analyze computer forensic evidence (K2)
5. Analyze Asset Misappropriation and Fraudulent disbursements (K3)
6. Compare and contrast different Prevention Methods (K3)

CO- PO, PSO MAPPING :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| C01 | 3 | 2 | 2 | 2 | 1 | 2 | - | 1 | - | - | 2 | 2 | 3 | 2 |
| C02 | 3 | 2 | 3 | 2 | 2 | 2 | - | 1 | - | - | 2 | 2 | 3 | 2 |
| C03 | 3 | 2 | 3 | 2 | 1 | 2 | - | 1 | - | - | 2 | 2 | 3 | 2 |
| C04 | 3 | 2 | 3 | 2 | 3 | 2 | - | 1 | - | - | 2 | 2 | 3 | 2 |
| C05 | 3 | 2 | 3 | 2 | 3 | 2 | - | 1 | 2 | 3 | 2 | 2 | 3 | 2 |
| C06 | 3 | 2 | 3 | 2 | 3 | 2 | - | 1 | 2 | 3 | 2 | 2 | 3 | 2 |

PROFESSIONAL ELECTIVES - IV

| | | | | | |
|--|---------------------------------------|----------|----------|----------|----------|
| 20MGEL801 SDG NO. 3,4,5,8,10, 13,14,15,16 | PROFESSIONAL ETHICS AND VALUES | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- An understanding of their duties and responsibilities as professionals through gaining knowledge of the philosophies of ethics, professional practice, and world culture.
- Basic knowledge to make informed ethical decisions when confronted with problems in the working environment.
- Improved awareness of potential ethical issues within an engineering context.
- Team skills through working in teams on assignments and in-class assignments.
- Subjective analytical skills through investigation and evaluation of ethical problems in engineering settings using accepted tests for moral problem solving.
- An understanding of how societal morals vary with culture and its influence on ethical thought and action.
- Improved communications skills with regard to ethical and professional issues in engineering.
- Know some of the classic cases as well as contemporary issues in engineering ethics.

UNIT I HUMAN VALUES

Morals, Values, and Ethics – Integrity –Trustworthiness – Work Ethics – Service-Learning – Civic Virtue – Respect for others – Living Peacefully –

Caring – Sharing – Honesty – Courage – Value Time – Co-operation – Commitment – Empathy – Self-confidence – Spirituality – Character.

UNIT II PRINCIPLES FOR HARMONY

Truthfulness – Customs and Traditions – Value Education – Human Dignity – Human Rights – Fundamental Duties – Aspirations and Harmony (I, We & Nature) – Gender Bias – Emotional Intelligence – Salovey – Mayer Model – Emotional Competencies – Conscientiousness.

UNIT III ENGINEERING ETHICS AND SOCIAL EXPERIMENTATION

History of Ethics – Need of Engineering Ethics – Senses of Engineering Ethics – Profession and Professionalism – Self Interest – Moral Autonomy – Utilitarianism – Virtue Theory – Uses of Ethical Theories – Deontology – Types of Inquiry – Kohlberg's Theory – Gilligan's Argument – Heinz's Dilemma – Comparison with Standard Experiments – Learning from the Past – Engineers as Managers – Consultants and Leaders – Balanced Outlook on Law – Role of Codes – Codes and Experimental Nature of Engineering.

UNIT IV ENGINEERS' RESPONSIBILITIES TOWARDS SAFETY AND RISK

The concept of Safety – Safety and Risk – Types of Risks – Voluntary v/s Involuntary Risk – Consequences – Risk Assessment – Accountability – Liability – Reversible Effects – Threshold Levels of Risk – Delayed v/s Immediate Risk – Safety and the Engineer – Designing for Safety – Risk-Benefit Analysis – Accidents.

UNIT V ENGINEERS' DUTIES AND RIGHTS

Concept of Duty – Professional Duties – Collegiality – Techniques for Achieving Collegiality – Senses of Loyalty – Consensus and Controversy – Professional and Individual Rights – Confidential and Proprietary Information – Conflict of Interest – Ethical egoism – Collective Bargaining – Confidentiality – Gifts and Bribes – Problem solving – Occupational Crimes – Industrial Espionage – Price Fixing – Whistle Blowing.

UNIT VI GLOBAL ISSUES

Globalization and MNCs – Cross Culture Issues – Business Ethics – Media Ethics – Environmental Ethics – Endangering Lives – Bio Ethics – Computer Ethics – War Ethics – Research Ethics – Intellectual Property Rights.

TEXT BOOKS:

1. Engineering Ethics & Human Values by M.Govindarajan, S.Natarajan and V.S.SenthilKumar-PHI Learning Pvt. Ltd – 2009

REFERENCE BOOKS:

1. Ethical Choices in Business Response Books, Sekhar, R.C: 1997, New Delhi, Sage Publications.
2. The Ethical Organisation, Kitson, Alan and Campebell, Robert: 1996. Great Britain Macmillan Press Ltd.
3. Engineering Ethics, Pinkus, Rosa Lyun B., Larry J Shulman, Norman Phummon, Harvey Wolfe: 1997, New York, Cambridge Uty., Press
4. Professional Ethics by R. Subramaniam – Oxford Publications, New Delhi.
5. Ethics in Engineering by Mike W. Martin and Roland Schinzinger – Tata McGraw-Hill – 2003.
6. Professional Ethics and Morals by Prof.A.R.Aryasri, Dharanikota Suyodhana – Maruthi Publications.
7. Engineering Ethics by Harris, Pritchard, and Rabins, Cengage Learning, New Delhi.
8. Human Values & Professional Ethics by S. B. Gogate, Vikas Publishing House Pvt. Ltd., Noida.
9. Professional Ethics and Human Values by A. Alavudeen, R.Kalil Rahman and M. Jayakumaran – University Science Press.
10. Professional Ethics and Human Values by Prof.D.R.Kiran-Tata McGraw-Hill – 2013
11. Human Values And Professional Ethics by Jayshree Suresh and B. S. Raghavan, S.Chand Publications

WEB RESOURCES

- 1 Ethos Education provides a concise guide on developing a code of ethics for primary and secondary schools.
- 2 The Ethics Resource Center has a toolkit available for use. When used for commercial purposes, a nominal license fee is required.
- 3 Creating A Code Of Ethics for Your Organization, with many suggested books, by Chris MacDonald
- 4 The Deloitte Center for Corporate Governance offers a variety of resources for those who are active in governance, including a variety of resources and a set of suggested guidelines for writing a code of ethics or a code of conduct.

MOOC REFERENCES:

- 1 <https://www.udemy.com/course/worldplace-ethics-and-attitude/>
- 2 <https://www.udemy.com/course/business-ethics-how-to-create-an-ethical-organization/>

- 3 [https://nptel.ac.in/courses/110/105/110105097/Ethics in Engineering Practice](https://nptel.ac.in/courses/110/105/110105097/Ethics%20in%20Engineering%20Practice)
- 4 [https://nptel.ac.in/courses/109/104/109104068/Human Values](https://nptel.ac.in/courses/109/104/109104068/Human%20Values)
- 5 <https://www.coursera.org/learn/ethics-technology-engineering>
- 6 <https://www.classcentral.com/course/ethics-technology-engineering-10485>

OUTCOMES:

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

- 1 Classify between ethical and non-ethical situations. (K2)
- 2 Discuss and practice moral judgment in conditions of dilemma. (K2)
- 3 Explain and relate the code of ethics to social experimentation and real world scenarios. (K2)
- 4 Describe risk and safety measures in various engineering fields. (K2)
- 5 Explain the impact of engineering solutions in a global/societal / professional context. (K2)

CO – PO, PSO MAPPING:

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

PROFESSIONAL ELECTIVE IV

| | | | | | |
|-----------------------|-----------------|---|---|---|---|
| 20CCEL804 SDG NO.4 | DATABASE TUNING | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To understand the fundamentals of relational databases, algebra and tuning.
- To learn the Normalization, denormalization, query optimization techniques, layouts, triggers and the methods of accessing multiple databases.
- To troubleshoot and analyze query access plan.

UNIT I FUNDAMENTALS OF TUNING

8

Review of Relational Databases – Relational Algebra - Locking and Concurrency Control – Correctness Consideration – Lock Tuning – Logging and the Recovery Subsystem – Principles of Recovery – Tuning the Recovery Subsystem – Operating Systems Considerations – Hardware Tuning.

UNIT II INDEX TUNING

8

Types of Queries – Data Structures – B tree – B+ Tree - Hash Structures – Bit Map Indexes – Clustering Indexes – Non Clustering Indexes – Composite Indexes – Hot Tables – Comparison of Indexing and Hashing Techniques.

UNIT III QUERY OPTIMIZATION

10

Techniques - Tuning Relational Systems – Normalization – Tuning Denormalization – Clustering Two Tables – Aggregate Maintenance – Record Layout – Query Tuning – Triggers – Client Server Mechanisms – Objects, Application Tools and Performance – Tuning the Application Interface – Bulk Loading Data – Accessing Multiple Databases.

UNIT IV TROUBLESHOOTING

10

Query Plan Explainers – Performance Monitors – Event Monitors – Finding “Suspicious” Queries – Analyzing a Query’s Access Plan – Profiling a Query Execution – DBMS Subsystems.

UNIT V CASE STUDIES

9

Transaction Chopping – Time Series Databases – Understanding Access Plans – Configuration Parameters: Oracle; SQL Server; DB2UDB – Distributed Database - Implementation.

TOTAL : 45 PERIODS

REFERENCES

1. Dennis Shasha and Philippe Bonnet “Database Tuning, Principles, Experiments, and Troubleshooting Techniques”, Elsevier Reprint 2005.
2. Thomas Connolly and Carolyn Begg, “Database Systems, A Practical Approach to Design, Implementation and Management”, Third Edition, Pearson Education 2003.
3. M.Tamer Ozsu, Patrick Valduriez and S.Sridhar “Principles of Distributed Database Systems”, Pearson Education 2007.

OUTCOMES:

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

- 1 Understand the concept of Relational Algebra (K2)
- 2 Denormalize Tuning to optimize multiple database access (K2)
- 3 Determine Types of Queries and Data Structures. (K2)
- 4 Analyze B tree, B+ Tree and Hash Structures (K3)
- 5 Discuss Tuning Relational Systems.(K2)
- 6 Compare and contrast Different Databases (K3)

CO- PO, PSO MAPPING :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| C01 | 3 | 2 | 2 | 3 | 1 | 2 | 2 | - | - | - | 2 | 2 | 3 | 2 |
| C02 | 3 | 2 | 3 | 2 | 1 | 2 | 1 | - | - | - | 2 | 2 | 3 | 2 |
| C03 | 3 | 3 | 3 | 3 | 2 | 3 | - | - | - | - | 2 | 2 | 3 | 3 |
| C04 | 3 | 3 | 3 | 2 | 3 | 2 | 1 | - | - | - | 2 | 2 | 3 | 3 |
| C05 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | - | 2 | 3 | 2 | 2 | 3 | 3 |
| C06 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | - | 2 | 3 | 2 | 2 | 3 | 3 |

PROFESSIONAL ELECTIVE IV

| | | | | | |
|-------------------------------------|--|----------|----------|----------|----------|
| 20CCEL805 SDG NO.4 | ANDROID APPLICATION DEVELOPMENT | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To learn the essentials of mobile apps development,
- To aid in developing simple android applications
- To identify the essentials of android design, file settings
- To study about user interface design and develop android APIs.

UNIT I MOBILE AND INFORMATION ARCHITECTURE 9

Introduction to Mobile: A brief history of Mobile, The Mobile Eco system, Why Mobile? Types of Mobile Applications. Mobile Design, Mobile 2.0, Mobile Web development, Small Computing Device Requirements.

UNIT II INTRODUCTION TO ANDROID 9

History of Mobile Software Development, The Open Handset Alliance-Android platform differences. The Android Platform, Android SDK, Eclipse Installation, Android Installation, Building a Sample Android application.

UNIT III ANDROID APPLICATION DESIGN ESSENTIALS 9

Anatomy of an Android applications, Android terminologies, Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents. Android Manifest File and its common settings, Using Intent Filter, Permissions, Managing Application resources in a hierarchy, working with different types of resources.

UNIT IV ANDROID USER INTERFACE DESIGN 9

Essentials User Interface Screen elements, Designing User Interfaces with Layouts. Drawing and Working with Animation- Drawing on the screen -Working with Text-Working with Bitmaps-Working with shapes-Working with animation.

UNIT V: ANDROID APPLICATIONS 9

Using Common Android APIs Using Android Data and Storage APIs, Managing data using SQLite, Sharing Data between Applications with Content Providers. Using Android Networking APIs, Using Android Web APIs, Using Android Telephony APIs, Deploying Android Application to the World.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. James Keogh, "J2ME: The Complete Reference", Tata McGrawHill.
2. Lauren Darcey and Shane Conder, "Android Wireless Application Development", Pearson Education, 2nd ed. (2011).

REFERENCE BOOKS:

1. Reto Meier, "Professional Android 2 Application Development", Wiley India Pvt Ltd.
2. Mark L Murphy, "Beginning Android", Wiley India Pvt Ltd.
3. Barry Burd, "Android Application Development All in one" Edition: I, Wiley India Pvt Ltd.

E-RESOURCES

1. <http://onlinevideolecture.com/ebooks/?subject=Android-Development>
2. <https://developer.android.com/training/basics/firstapp/index.html>
3. IEEE Transactions on Mobile Computing
4. International Journal of Interactive Mobile Technologies
5. <http://nptel.ac.in/courses/106106147/>

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

1. Classify different types of Platforms.(K2)
2. Appreciate the Mobility landscape (K2)
3. Familiarize with Mobile apps development aspects. (K2)
4. Design and develop mobile apps, using Android as development platform, with key focus on user experience design, native data handling and background tasks and notifications. (K3)
5. Perform testing, signing, packaging and distribution of mobile apps (K3)
6. Understand recent trends in Android.(K2)

CO- PO, PSO MAPPING :

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| C01 | 2 | 3 | | - | | - | - | - | | - | - | - | - | - |
| C02 | - | - | 3 | - | 3 | - | - | - | | - | - | - | - | - |
| C03 | - | - | 3 | - | 3 | - | | - | | - | - | - | - | - |
| C04 | - | - | - | 2 | | - | 1 | - | | - | - | - | - | - |
| C05 | - | - | - | - | - | - | 1 | - | 3 | - | - | 3 | - | - |
| C06 | 2 | 1 | 2 | 2 | - | - | - | 2 | - | 1 | - | - | - | - |

PROFESSIONAL ELECTIVES - III

| | | | | | |
|-----------------------------------|---|----------|----------|----------|----------|
| 20CSEL706 SDG NO. 4 & 9 | MULTI-CORE ARCHITECTURES AND PROGRAMMING | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To understand the need for Multi-core processors and their architectures
- To understand the challenges in Parallel and Multi-threaded programming
- To learn about the various Parallel Programming paradigms
- To develop Multi-core programs and design parallel solutions

UNIT I MULTI-CORE PROCESSORS**9**

Single core to Multi-core Architectures - SIMD and MIMD Systems- Interconnection Networks-Symmetric and Distributed Shared Memory Architectures- Cache Coherence - Performance Issues - Parallel Program Design.

UNIT II PARALLEL PROGRAM CHALLENGES**9**

Performance - Scalability - Synchronization and Data Sharing - Data Races - Synchronization Primitives (Mutexes, Locks, Semaphores, Barriers) - Deadlocks and LiveLocks - Communication between Threads (Condition Variables - Signals - Message Queues and Pipes).

UNIT III SHARED MEMORY PROGRAMMING WITH OpenMP**9**

OpenMP Execution Model - Memory Model - OpenMP Directives - Work-sharing Constructs - Library functions - Handling Data and Functional Parallelism - Handling Loops - Performance Considerations

UNIT IV DISTRIBUTED MEMORY PROGRAMMING WITH MPI 9

MPI Program Execution - MPI Constructs - Libraries - MPI Send and Receive - Point-to-Point and Collective Communication - MPI Derived Data Types - Performance Evaluation.

UNIT V PARALLEL PROGRAM DEVELOPMENT 9

Case studies - n-body Solvers - Tree Search - OpenMP and MPI Implementations and Comparison.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Peter S. Pacheco, "An Introduction to Parallel Programming", Morgan-Kaufman/Elsevier, 2011.
2. Darryl Gove, "Multicore Application Programming for Windows, Linux, and Oracle Solaris", Pearson, 2011 (Unit 2).

REFERENCES:

1. Michael J Quinn, "Parallel programming in C with MPI and OpenMP", Tata McGraw Hill, 2003.
2. Shameem Akhter and Jason Roberts, "Multi-core Programming", Intel Press, 2006.
3. Yan Solihin, "Fundamentals of Parallel Multicore Architecture" CRC press, 2015.
4. John L. Hennessey and David A. Patterson, "Computer Architecture – A Quantitative Approach", Morgan Kaufmann / Elsevier, 5th edition, 2012.
5. Richard Y. Kain, "Advanced Computer Architecture a Systems Design Approach", Prentice Hall, 2011.

WEB REFERENCES:

1. https://swayam.gov.in/nd1_noc19_cs45/preview

ONLINE RESOURCES:

1. <https://youtube.be/FauseE2FtUsY>
2. <https://slideplayer.com/slide/7106313/&9784375>

OUTCOMES:

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

1. Understand the basics of Multi-core Architectures. (K2)
2. Understand the challenges in Parallel and Multithreaded programming. (K2)

3. Explain about the various Parallel Programming paradigms and solutions.(K2)
4. Identify the issues in programming Parallel Processors.(K2)
5. Write programs using Open MP and MPI. (K3)
6. Compare and contrast programming for Serial Processors and programming for Parallel Processors.(K2)

CO- PO, PSO MAPPING:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 2 | 2 | 1 | 2 | 2 | 1 | 2 | - | 1 | 2 | - | 1 | 3 | 1 |
| CO2 | 2 | 3 | 1 | 2 | 2 | 1 | 2 | - | 1 | 2 | - | 1 | 3 | 1 |
| CO3 | 2 | 1 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 1 |
| CO4 | 3 | 2 | 1 | 1 | 2 | 1 | - | - | 1 | 2 | 2 | 3 | 3 | 1 |
| CO5 | 2 | 2 | 1 | 2 | 2 | 1 | - | - | 1 | 2 | 2 | 3 | 3 | 1 |
| CO6 | 2 | 2 | - | 1 | 2 | 1 | - | - | 1 | 2 | 2 | 3 | 3 | 1 |

PROFESSIONAL ELECTIVES - IV

| | | | | | |
|-------------------------------|--------------------------|----------|----------|----------|----------|
| 20CSEL806 SDG NO. 4 | COGNITIVE SCIENCE | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

OBJECTIVES:

- To learn about theories, methods and discoveries in cognitive science, the historical context and the philosophical roots that allowed the rising of this multidisciplinary field of studies.
- To help students develop general scientific thinking and study skills that will be an important requirement for all the master courses
- To help students understand cognitive science application to real world artefacts.
- To help students to develop a critical approach to scientific research and literature

UNIT I INTRODUCTION TO COGNITIVE SCIENCE, PSYCHOLOGY, NERVOUS SYSTEM AND BRAIN**9**

Introduction to the study of cognitive sciences. A brief history of cognitive science. Methodological concerns in philosophy, artificial intelligence and

psychology. Structure and constituents of the brain; Brief history of neuroscience; Mathematical models; Looking at brain signals.

UNIT II BRAIN AND SENSORY MOTOR INFORMATION, REPRESENTATION OF SENSORY INFORMATION FROM SENSATION TO COGNITION AND ROOTS OF COGNITIVE SCIENCE **9**

Processing of sensory information in the brain; Neural Network Models; Processing of sensory information in the brain; motor and sensory areas; Brain Imaging, fMRI, MEG, PET, EEG, Multisensory integration in cortex; information fusion; from sensation to cognition, cybernetics; From physics to meaning; Analog vs. Digital: Code duality

UNIT III LANGUAGE AND EMBODIMENT **9**

What is language?; Linguistic knowledge: Syntax, semantics, (and pragmatics); Generative linguistics; Brain and language; Language disorders; Lateralization; The great past tense debate. Cognitivist and emergent standpoints; A robotic perspective

UNIT IV AFFORDANCE IN BIOLOGICAL AND ARTIFICIAL SYSTEM AND COGNITIVE DEVELOPMENT, ATTENTION **9**

Affordances, direct perception, Ecological Psychology, affordance learning in robotics, Development, child and robotic development, Attention and related concepts; Human visual attention; Computational models of attention; Applications of computational models of attention.

UNIT V LEARNING –MEMORY AND REASONING **9**

Categories and concepts; Concept learning; Logic ; Machine learning, Constructing memories; Explicit vs. implicit memory; Information processing (three-boxes) model of memory; Sensory memory; Short term memory; Long term memory, Rationality; Bounded rationality; Prospect theory ; Heuristics and biases; Reasoning in computers

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Gardner, The Mind's New Science, Gardner, Howard E, "The mind's new science: A history of the cognitive revolution", Basic books, 2008.
2. José Luis Bermúdez, "Cognitive Science: An Introduction to the Science of the Mind", Cambridge University Press, New York, 2014.

REFERENCES:

1. Michael I Posner, "The Foundations of Cognitive Science", MIT Press, Prentice October 1993
2. José Luis Bermúdez, "Cognitive Science: An Introduction to the Science of the Mind", Cambridge University Press, August 2010.
3. Gilbert Ryle, "The Concept of Mind", Cambridge University Press, 2003.
4. Pranjali Deshpande, Soudamini Patil, "Evolution of the Brain and Intelligence", Cambridge University Press, 2003.
5. Miller, Earl K., and Jonathan D. Cohen. "An Integrative Theory of Prefrontal Cortex Function." *Annu Rev Neurosci* 24 (2001): 167-202.
6. Bermudez Wallace, Mark T., and Barry E. Stein. "Sensory organization of the superior colliculus in cat and monkey." *Progress in brain research* 112 (1996): 301-311.

WEB REFERENCES:

1. https://onlinecourses.nptel.ac.in/noc21_hs105/preview
2. https://onlinecourses.nptel.ac.in/noc20_hs29/preview

ONLINE RESOURCES:

1. https://en.wikipedia.org/wiki/Cognitive_science
2. <https://plato.stanford.edu/entries/cognitive-science/>
3. <https://cognitivesciencesociety.org/>
4. <https://www.forcepoint.com/cyber-edu/cognitive-science>

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

1. Compare and contrast different philosophical views on the nature of mind.(K3)
2. Apply basic Artificial Intelligence techniques to solve some simple problems.(K3)
3. Interpret findings from cognitive psychology and cognitive neuroscience.(K3)
4. Discuss social, evolutionary, and other ecological aspects of cognition.(K2)
5. Promote cognitive science.(K1)
6. Understand the concept of memory.(K1)

CO- PO, PSO MAPPING:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PS01 | PS02 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 2 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | - | 2 | 1 | 2 | 2 | 2 |
| CO2 | 3 | 1 | 1 | 2 | - | 1 | 2 | - | 1 | - | 2 | 2 | 2 | 1 |
| CO3 | 2 | 1 | 3 | 1 | - | 2 | 1 | 2 | - | 2 | 2 | 2 | 2 | 1 |
| CO4 | 3 | 1 | 2 | 2 | 2 | 1 | - | 1 | 1 | - | 2 | 1 | 3 | 2 |
| CO5 | 2 | 1 | 3 | 1 | 2 | 2 | 1 | - | 2 | 3 | 2 | 2 | 3 | 2 |
| CO6 | 3 | 1 | 3 | 1 | 2 | 2 | 1 | - | 2 | 3 | 2 | 2 | 3 | 2 |

Imagine the Future and Make it happen!



1 NO POVERTY



2 ZERO HUNGER



3 GOOD HEALTH AND WELL-BEING



4 QUALITY EDUCATION



5 GENDER EQUALITY



6 CLEAN WATER AND SANITATION



7 AFFORDABLE AND CLEAN ENERGY



8 DECENT WORK AND ECONOMIC GROWTH



9 INDUSTRY, INNOVATION AND INFRASTRUCTURE



10 REDUCED INEQUALITIES



11 SUSTAINABLE CITIES AND COMMUNITIES



12 RESPONSIBLE CONSUMPTION AND PRODUCTION



13 CLIMATE ACTION



14 LIFE BELOW WATER



15 LIFE ON LAND



16 PEACE, JUSTICE AND STRONG INSTITUTIONS



17 PARTNERSHIPS FOR THE GOALS



Together let's build a better world where there is **NO POVERTY** and **ZERO HUNGER**.

We have **GOOD HEALTH AND WELL BEING**, **QUALITY EDUCATION** and full **GENDER EQUALITY** everywhere.

There is **CLEAN WATER AND SANITATION** for everyone. **AFFORDABLE AND CLEAN ENERGY**

which will help to create **DECENT WORK AND ECONOMIC GROWTH**. Our prosperity shall be fuelled

by investments in **INDUSTRY, INNOVATION AND INFRASTRUCTURE** that will help us to

REDUCE INEQUALITIES by all means. We will live in **SUSTAINABLE CITIES AND COMMUNITIES**.

RESPONSIBLE CONSUMPTION AND PRODUCTION will help in healing our planet.

CLIMATE ACTION will reduce global warming and we will have abundant,

flourishing **LIFE BELOW WATER**, rich and diverse **LIFE ON LAND**.

We will enjoy **PEACE AND JUSTICE** through **STRONG INSTITUTIONS**

and will build long term **PARTNERSHIPS FOR THE GOALS**.



For the goals to be reached,
everyone needs to do their part:
governments, the private sector,
civil society and **People like you.**

Together we can...

Sai Prakash Leo Mathew

CEO - Sairam Institutions

We build a Better nation
through Quality education.



Sri

SAI RAM INSTITUTE OF TECHNOLOGY

An Autonomous Institution

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