



**New Prince Shri Bhavani College
Of Engineering and Technology**
(An Autonomous Institution)

CURRICULUM

&

SYLLABUS (1 to 8 SEM.)

(REGULATION 2023)

FOR

**B.E. – COMPUTER SCIENCE AND ENGINEERING
(CHOICE BASED CREDIT SYSTEM)**

(Applicable to the students admitted from the Academic Year 2023-24)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

SEMESTER - I

| Sl. No. | Course Category | Course Code | Course Title | L | T | P | Total Contact Periods | Credits |
|--------------------------|-----------------|-------------|--|---|---|---|-----------------------|---------|
| THEORY COURSES | | | | | | | | |
| 1 | HS | U23EN101 | Technical English - I | 3 | 0 | 0 | 3 | 3 |
| 2 | BS | U23MA101 | Engineering Mathematics | 3 | 1 | 0 | 4 | 4 |
| 3 | BS | U23PH101 | Engineering Physics | 3 | 0 | 0 | 3 | 3 |
| 4 | BS | U23CY101 | Engineering Chemistry | 3 | 0 | 0 | 3 | 3 |
| 5 | ES | U23CP101 | Programming in C | 3 | 0 | 2 | 5 | 4 |
| 6 | ES | U23BE104 | Basic Electrical and Electronics Engineering | 3 | 0 | 0 | 3 | 3 |
| 7 | HS | U23TA101 | தமிழர் மரபு /Heritage of Tamils | 1 | 0 | 0 | 1 | 1 |
| PRACTICAL COURSES | | | | | | | | |
| 8 | BS | U23PC101 | Physics and Chemistry Laboratory | 0 | 0 | 3 | 3 | 1.5 |
| 9 | HS | U23EN102 | Professional Communication Laboratory | 0 | 0 | 3 | 3 | 1.5 |
| 10 | SIP | U23IP101 | Student Induction Programme | 0 | 0 | 0 | 2 Weeks | 0 |
| TOTAL CREDITS | | | | | | | | 24 |

SEMESTER - II


| Sl. No. | Course Category | Course Code | Course Title | L | T | P | Total Contact Periods | Credits |
|--------------------------|-----------------|-------------|--|---|---|---|-----------------------|---------|
| THEORY COURSES | | | | | | | | |
| 1 | HS | U23EN201 | Technical English - II | 3 | 0 | 0 | 3 | 3 |
| 2 | BS | U23MA201 | Vector Calculus and Complex Functions | 3 | 1 | 0 | 4 | 4 |
| 3 | BS | U23PH203 | Physics for Computer Technology | 3 | 0 | 0 | 3 | 3 |
| 4 | ES | U23EG101 | Engineering Graphics | 2 | 0 | 4 | 6 | 4 |
| 5 | ES | U23PY201 | Problem Solving and Python Programming | 3 | 0 | 2 | 5 | 4 |
| 6 | PC | U23CS201 | Data Structures | 3 | 0 | 0 | 3 | 3 |
| 7 | HS | U23TA201 | தமிழரும் தொழில்நுட்பமும் / Tamils and Technology | 1 | 0 | 0 | 1 | 1 |
| PRACTICAL COURSES | | | | | | | | |
| 8 | ES | U23EP101 | Engineering Practices Laboratory | 0 | 0 | 3 | 3 | 1.5 |
| 9 | PC | U23CS202 | Data Structures Laboratory | 0 | 0 | 3 | 3 | 1.5 |
| TOTAL CREDITS | | | | | | | | 25 |

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| SEMESTER - III | | | | | | | | |
|---|-----------------|-------------|--|---|---|---|-----------------------|-----------|
| Sl. No. | Course Category | Course Code | Course Title | L | T | P | Total Contact Periods | C |
| THEORY COURSES | | | | | | | | |
| 1 | BS | U23MA302 | Discrete Mathematics | 3 | 1 | 0 | 4 | 4 |
| 2 | ES | U23EC301 | Digital Principles and Computer Organization | 3 | 0 | 2 | 5 | 4 |
| 3 | PC | U23CS301 | Foundation of Data Science | 3 | 0 | 0 | 3 | 3 |
| 4 | PC | U23CS302 | Data Base Management Systems | 3 | 0 | 0 | 3 | 3 |
| 5 | PC | U23CS303 | Object Oriented Programming | 3 | 0 | 2 | 5 | 4 |
| 6 | MNC | U23MX01 | Personal Values | 2 | 0 | 0 | 2 | 0 |
| PRACTICAL COURSE | | | | | | | | |
| 7 | PC | U23CS304 | Data Science laboratory | 0 | 0 | 3 | 3 | 1.5 |
| 8 | PC | U23CS305 | Database Management System Laboratory | 0 | 0 | 3 | 3 | 1.5 |
| EMPLOYABILITY ENHANCEMENT COURSE | | | | | | | | |
| 9 | EEC | U23EEC301 | Employability Skills - I | 0 | 0 | 2 | 2 | 1 |
| TOTAL CREDITS | | | | | | | | 22 |

| SEMESTER - IV | | | | | | | | |
|---|-----------------|-------------|--------------------------------|---|---|---|-----------------------|-----------|
| Sl. No. | Course Category | Course Code | Course Title | L | T | P | Total Contact Periods | C |
| THEORY COURSES | | | | | | | | |
| 1 | PC | U23CS401 | Machine Learning Techniques | 3 | 0 | 2 | 5 | 4 |
| 2 | PC | U23CS402 | Design Analysis and Algorithms | 3 | 0 | 2 | 5 | 4 |
| 3 | PC | U23CS403 | Theory of Computation | 3 | 0 | 0 | 3 | 3 |
| 4 | PC | U23CS404 | Operating Systems | 3 | 0 | 0 | 3 | 3 |
| 5 | PC | U23CS405 | Computer Networks | 3 | 0 | 0 | 3 | 3 |
| 6 | PC | U23CS406 | Software Engineering | 3 | 0 | 0 | 3 | 3 |
| PRACTICAL COURSE | | | | | | | | |
| 7 | PC | U23CS407 | Operating Systems Laboratory | 0 | 0 | 3 | 3 | 1.5 |
| 8 | PC | U23CS408 | Computer Networks Laboratory | 0 | 0 | 3 | 3 | 1.5 |
| EMPLOYABILITY ENHANCEMENT COURSE | | | | | | | | |
| 9 | EEC | U23EEC402 | Employability Skills - II | 0 | 0 | 2 | 2 | 1 |
| TOTAL CREDITS | | | | | | | | 24 |


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| SEMESTER- V | | | | | | | | |
|---|-----------------|-------------|--|---|---|---|-----------------------|-----------|
| Sl. No. | Course Category | Course Code | Course Title | L | T | P | Total Contact Periods | Credits |
| THEORY COURSES | | | | | | | | |
| 1 | PC | U23CS501 | Compiler Design | 3 | 0 | 0 | 3 | 3 |
| 2 | PC | U23CS502 | Cryptography and Network Security | 3 | 0 | 0 | 3 | 3 |
| 3 | PC | U23CS503 | Object Oriented Analysis and Design | 3 | 0 | 0 | 3 | 3 |
| 4 | HS | U23MG501 | Professional Ethics and IPR | 2 | 0 | 0 | 2 | 2 |
| 5 | PE | U23PEXXXX | Professional Elective - I | | | | | 3 |
| 6 | PE | U23PEXXXX | Professional Elective - II | | | | | 3 |
| 7 | MNC | U23MX02 | Environmental Sciences and Sustainability | 2 | 0 | 0 | 2 | 0 |
| 8 | HS | U23FLXX | Foreign Language | 3 | 0 | 0 | 2 | 2 |
| PRACTICAL COURSE | | | | | | | | |
| 9 | PC | U23CS504 | Security Laboratory | 0 | 0 | 3 | 3 | 1.5 |
| 10 | PC | U23CS505 | Object Oriented Analysis and Design Laboratory | 0 | 0 | 3 | 3 | 1.5 |
| EMPLOYABILITY ENHANCEMENT COURSE | | | | | | | | |
| 11 | EEC | U23EEC501 | Employability Skills - III | 3 | 0 | 0 | 3 | 1 |
| TOTAL CREDITS | | | | | | | | 23 |

| SEMESTER- VI | | | | | | | | |
|--|-----------------|-------------|-----------------------------|---|---|---|-----------------------|-----------|
| Sl. No. | Course Category | Course Code | Course Title | L | T | P | Total Contact Periods | Credits |
| THEORY COURSES | | | | | | | | |
| 1 | PC | U23CS601 | Embedded System and IOT | 3 | 0 | 2 | 5 | 4 |
| 2 | PC | U23CS602 | Distributed Computing | 3 | 0 | 0 | 3 | 3 |
| 3 | PC | U23CB501 | Cyber Security | 3 | 0 | 2 | 5 | 4 |
| 4 | PE | U23PEXXXX | Professional Elective - III | | | | | 3 |
| 5 | PE | U23PEXXXX | Professional Elective - IV | | | | | 3 |
| 6 | OE | U23OE1XX | Open Elective - I | 3 | 0 | 0 | 3 | 3 |
| EMPLOYABILITY ENHANCEMENT COURSES | | | | | | | | |
| 7 | EEC | U23EEC601 | Employability Skills - IV | 3 | 0 | 0 | 3 | 1 |
| 8 | EEC | U23EEC602 | Internship | 0 | 0 | 0 | 0 | 1 |
| TOTAL CREDITS | | | | | | | | 22 |


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| SEMESTER - VII | | | | | | | | |
|--|-----------------|-------------|--------------------------------|---|---|---|-----------------------|-----------|
| Sl. No. | Course Category | Course Code | Course Title | L | T | P | Total Contact Periods | Credits |
| THEORY COURSES | | | | | | | | |
| 1 | PC | U23CS701 | Cloud Computing | 3 | 0 | 0 | 3 | 3 |
| 2 | PC | U23AI502 | Big data Analytics | 3 | 0 | 0 | 3 | 3 |
| 3 | HS | U23MG701 | Project Management and Finance | 2 | 0 | 0 | 2 | 2 |
| 4 | PE | U23PEXXX | Professional Elective - V | | | | | 3 |
| 5 | PE | U23PEXXX | Professional Elective - VI | | | | | 3 |
| 6 | OE | U23OE2XX | Open Elective - II | 3 | 0 | 0 | 3 | 3 |
| PRACTICAL COURSE | | | | | | | | |
| 7 | PC | U23CS702 | Cloud Computing Laboratory | 0 | 0 | 3 | 3 | 1.5 |
| 8 | PC | U23AI505 | Bid Data Analytics Laboratory | 0 | 0 | 3 | 3 | 1.5 |
| EMPLOYABILITY ENHANCEMENT COURSES | | | | | | | | |
| 9 | EEC | U23CS703 | Mini Project | 0 | 0 | 2 | 2 | 1 |
| 10 | PC | U23CS704 | Comprehensive Review | 0 | 0 | 2 | 2 | 1 |
| TOTAL CREDITS | | | | | | | | 22 |

| SEMESTER - VIII | | | | | | | | |
|-------------------------|-----------------|-------------|--------------|---|---|----|-----------------------|----------|
| Sl. No. | Course Category | Course Code | Course Title | L | T | P | Total Contact Periods | Credits |
| PRACTICAL COURSE | | | | | | | | |
| 1 | EEC | U23CS801 | Project Work | 0 | 0 | 16 | 16 | 8 |
| TOTAL CREDITS | | | | | | | | 8 |

TOTAL CREDITS: 170

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| PROFESSIONAL ELECTIVE COURSES : VERTICALS | | | | | | | | | | | |
|---|--|-------------|--|-------------|----------------------------------|-------------|---|-------------|---------------------------------|-------------|--|
| Course Code | Vertical I | Course Code | Vertical II | Course Code | Vertical III | Course Code | Vertical IV | Course Code | Vertical V | Course Code | Vertical VI |
| | Visual and Interactive Multimedia Technologies | | Computational Perceptions | | Web-Based Software Development | | Digital Transformation Technologies | | Cloud Computing | | Artificial Intelligence & Machine Learning |
| U23PECS01 | Multimedia Communication & Networking | U23PECS07 | Computer Vision & Image Processing | U23PECS13 | Web-based technologies | U23PECS19 | Digital Transmission | U23PECS25 | Enterprise Service Architecture | U23PECS31 | Artificial Intelligence for Robotics |
| U23PECS02 | User Interface Design | U23PECS08 | Neural Networks and Deep Learning | U23PECS14 | Application building | U23PECS20 | Database Security | U23PECS26 | Soft Computing Techniques | U23PECS32 | Fundamentals of Computational intelligence |
| U23PECS03 | Multimedia Design Programming | U23PECS09 | AI for Cyber Security | U23PECS15 | Cloud system management | U23PECS21 | Multimedia Data Compression and Storage | U23PECS27 | Green Computing | U23PECS33 | Advanced Business Intelligence & Analytics |
| U23PECS04 | Computer Graphics | U23PECS10 | AI Tools for Natural Language Processing | U23PECS16 | Interaction design | U23PECS22 | Technological Systems Visualization | U23PECS28 | Cloud Service Managemnet | U23PECS34 | Artificial Intelligence and Expert Systems |
| U23PECS05 | Computer Modelling & Animation | U23PECS11 | Nature & Bio - Inspired Computing | U23PECS17 | Quality assurance and automation | U23PECS23 | Computer Imaginatives | U23PECS29 | Parallel Computing | U23PECS35 | Artificial Neural networks |
| U23PECS06 | Multimedia Security | U23PECS12 | Feature Engineering | U23PECS18 | Web application protection | U23PECS24 | Video Creation and Editing | U23PECS30 | Social Network Analysis | U23PECS36 | Advanced Machine Learning Techniques |


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PROFESSIONAL ELECTIVE COURSES: VERTICALS

| VERTICAL 1 : Visual and Interactive Multimedia Technologies | | | | | | | | |
|--|-----------------|-------------|---------------------------------------|---|---|---|-----------------------|---------|
| Sl. No. | Course Category | Course Code | Course Title | L | T | P | Total Contact Periods | Credits |
| 1 | PE | U23PECS01 | Multimedia Communication & Networking | 3 | 0 | 0 | 3 | 3 |
| 2 | PE | U23PECS02 | User Interface Design | 3 | 0 | 0 | 3 | 3 |
| 3 | PE | U23PECS03 | Multimedia Design Programming | 3 | 0 | 0 | 3 | 3 |
| 4 | PE | U23PECS04 | Computer Graphics | 2 | 0 | 2 | 4 | 3 |
| 5 | PE | U23PECS05 | Computer Modelling & Animation | 2 | 0 | 2 | 4 | 3 |
| 6 | PE | U23PECS06 | Multimedia Security | 3 | 0 | 0 | 3 | 3 |

| VERTICAL 2 : Computational Perceptions | | | | | | | | |
|---|-----------------|-------------|--|---|---|---|-----------------------|---------|
| Sl. No. | Course Category | Course Code | Course Title | L | T | P | Total Contact Periods | Credits |
| 1 | PE | U23PECS07 | Computer Vision & Image Processing | 3 | 0 | 0 | 3 | 3 |
| 2 | PE | U23PECS08 | Neural Networks and Deep Learning | 2 | 0 | 2 | 4 | 3 |
| 3 | PE | U23PECS09 | AI for Cyber Security | 3 | 0 | 0 | 3 | 3 |
| 4 | PE | U23PECS10 | AI Tools for Natural Language Processing | 2 | 0 | 2 | 4 | 3 |
| 5 | PE | U23PECS11 | Nature & Bio - Inspired Computing | 3 | 0 | 0 | 3 | 3 |
| 6 | PE | U23PECS12 | Feature Engineering | 3 | 0 | 0 | 3 | 3 |

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| VERTICAL 3 : Web-Based Software Development | | | | | | | | |
|---|-----------------|-------------|----------------------------------|---|---|---|-----------------------|---------|
| Sl. No. | Course Category | Course Code | Course Title | L | T | P | Total Contact Periods | Credits |
| 1 | PE | U23PECS13 | Web-based technologies | 3 | 0 | 0 | 3 | 3 |
| 2 | PE | U23PECS14 | Application building | 3 | 0 | 0 | 3 | 3 |
| 3 | PE | U23PECS15 | Cloud system management | 2 | 0 | 2 | 4 | 3 |
| 4 | PE | U23PECS16 | Interaction design | 3 | 0 | 0 | 3 | 3 |
| 5 | PE | U23PECS17 | Quality assurance and automation | 2 | 0 | 2 | 4 | 3 |
| 6 | PE | U23PECS18 | Web application protection | 2 | 0 | 2 | 4 | 3 |

| VERTICAL 4 : Digital Transformation Technologies | | | | | | | | |
|--|-----------------|-------------|---|---|---|---|-----------------------|---------|
| Sl. No. | Course Category | Course Code | Course Title | L | T | P | Total Contact Periods | Credits |
| 1 | PE | U23PECS19 | Digital Transmission | 3 | 0 | 0 | 3 | 3 |
| 2 | PE | U23PECS20 | Database Security | 2 | 0 | 2 | 4 | 3 |
| 3 | PE | U23PECS21 | Multimedia Data Compression and Storage | 2 | 0 | 2 | 4 | 3 |
| 4 | PE | U23PECS22 | Technological Systems Visualization | 2 | 0 | 2 | 4 | 3 |
| 5 | PE | U23PECS23 | Computer Imaginatives | 3 | 0 | 0 | 3 | 3 |
| 6 | PE | U23PECS24 | Video Creation and Editing | 3 | 0 | 0 | 3 | 3 |

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VERTICAL 5 : Cloud Computing

| Sl. No. | Course Category | Course Code | Course Title | L | T | P | Total Contact Periods | Credits |
|---------|-----------------|-------------|---------------------------------|---|---|---|-----------------------|---------|
| 1 | PE | U23PECS25 | Enterprise Service Architecture | 3 | 0 | 0 | 3 | 3 |
| 2 | PE | U23PECS26 | Soft Computing Techniques | 3 | 0 | 0 | 3 | 3 |
| 3 | PE | U23PECS27 | Green Computing | 3 | 0 | 0 | 3 | 3 |
| 4 | PE | U23PECS28 | Cloud Service Managemnet | 3 | 0 | 0 | 3 | 3 |
| 5 | PE | U23PECS29 | Parallel Computing | 3 | 0 | 0 | 3 | 3 |
| 6 | PE | U23PECS30 | Social Network Analysis | 3 | 0 | 0 | 3 | 3 |

VERTICAL 6 : Artificial Intelligence & Machine Learning

| Sl. No. | Course Category | Course Code | Course Title | L | T | P | Total Contact Periods | Credits |
|---------|-----------------|-------------|--|---|---|---|-----------------------|---------|
| 1 | PE | U23PECS31 | Artificial Intelligence for Robotics | 2 | 0 | 2 | 4 | 3 |
| 2 | PE | U23PECS32 | Fundamentals of Computational intelligence | 3 | 0 | 0 | 3 | 3 |
| 3 | PE | U23PECS33 | Advanced Business Intelligence & Analytics | 3 | 0 | 0 | 3 | 3 |
| 4 | PE | U23PECS34 | Artificial Intelligence and Expert Systems | 2 | 0 | 2 | 4 | 3 |
| 5 | PE | U23PECS35 | Artificial Neural networks | 2 | 0 | 2 | 4 | 3 |
| 6 | PE | U23PECS36 | Advanced Machine Learning Techniques | 2 | 0 | 2 | 4 | 3 |


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SET I - OPEN ELECTIVES for CSE, IT, AIDS and Cyber Security

| SL. NO. | COURSE CODE | COURSE TITLE | L | T | P | Total Contact Periods | Credits |
|---------|-------------|--|---|---|---|-----------------------|---------|
| 1 | U230E101 | Algebra and Number Theory | 3 | 0 | 0 | 3 | 3 |
| 2 | U230E102 | Probability and Queueing Theory | 3 | 0 | 0 | 3 | 3 |
| 3 | U230E103 | Probability and Random Processes | 3 | 0 | 0 | 3 | 3 |
| 4 | U230E104 | Linear Algebra | 3 | 0 | 0 | 3 | 3 |
| 5 | U230E105 | Everyday Physics | 3 | 0 | 0 | 3 | 3 |
| 6 | U230E106 | Consumer Awareness on Appliances | 3 | 0 | 0 | 3 | 3 |
| 7 | U230E107 | Bio Physics | 3 | 0 | 0 | 3 | 3 |
| 8 | U230E108 | Astrophysics | 3 | 0 | 0 | 3 | 3 |
| 9 | U230E109 | Introduction to Nanoscience and Nanotechnology | 3 | 0 | 0 | 3 | 3 |
| 10 | U230E110 | Green Technology | 3 | 0 | 0 | 3 | 3 |
| 11 | U230E111 | The Environment and Society | 3 | 0 | 0 | 3 | 3 |
| 12 | U230E112 | Industrial corrosion and Prevention | 3 | 0 | 0 | 3 | 3 |
| 13 | U230E113 | English Through Media | 3 | 0 | 0 | 3 | 3 |
| 14 | U230E114 | English for Employability Skills | 3 | 0 | 0 | 3 | 3 |
| 15 | U230E115 | Inventions and Applications | 3 | 0 | 0 | 3 | 3 |
| 16 | U230E116 | Public Policy and Governance | 3 | 0 | 0 | 3 | 3 |
| 17 | U230E117 | Introduction to Mobile Communication | 3 | 0 | 0 | 3 | 3 |
| 18 | U230E118 | Basics of Signals and its Processing | 3 | 0 | 0 | 3 | 3 |
| 19 | U230E119 | Introduction to Communication Systems | 3 | 0 | 0 | 3 | 3 |
| 20 | U230E120 | Drone Technologies | 3 | 0 | 0 | 3 | 3 |
| 21 | U230E121 | Geographical Information System | 3 | 0 | 0 | 3 | 3 |
| 22 | U230E122 | Fundamentals of Electric and Hybrid Vehicle | 3 | 0 | 0 | 3 | 3 |
| 23 | U230E123 | Introduction to PLC Programming | 3 | 0 | 0 | 3 | 3 |
| 24 | U230E124 | Energy Management and Auditing | 3 | 0 | 0 | 3 | 3 |
| 25 | U230E125 | Fundamentals of Robotics | 3 | 0 | 0 | 3 | 3 |
| 26 | U230E126 | Medical Instrumentation | 3 | 0 | 0 | 3 | 3 |
| 27 | U230E137 | Applied Design Thinking | 3 | 0 | 0 | 3 | 3 |
| 28 | U230E138 | Fire Safety Engineering | 3 | 0 | 0 | 3 | 3 |
| 29 | U230E139 | Functional Materials | 3 | 0 | 0 | 3 | 3 |
| 30 | U230E140 | Fundamentals of Aeronautical Engineering | 3 | 0 | 0 | 3 | 3 |
| 31 | U230E141 | Industrial Design & Rapid Prototyping Techniques | 3 | 0 | 0 | 3 | 3 |

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SET II - OPEN ELECTIVES for CSE, IT, AIDS and Cyber Security

| SL. NO. | COURSE CODE | COURSE TITLE | L | T | P | Total Contact Periods | Credits |
|---------|-------------|--|---|---|---|-----------------------|---------|
| 1 | U230E201 | Statistics and Numerical Methods | 3 | 0 | 0 | 3 | 3 |
| 2 | U230E202 | Resource Management Techniques | 3 | 0 | 0 | 3 | 3 |
| 3 | U230E203 | Graph Theory | 3 | 0 | 0 | 3 | 3 |
| 4 | U230E204 | Operations Research | 3 | 0 | 0 | 3 | 3 |
| 5 | U230E205 | Scientific Principles in Historical Monuments | 3 | 0 | 0 | 3 | 3 |
| 6 | U230E206 | Non-Conventional Energy Sources | 3 | 0 | 0 | 3 | 3 |
| 7 | U230E207 | Environmental Physics | 3 | 0 | 0 | 3 | 3 |
| 8 | U230E208 | Entrepreneurship Development | 3 | 0 | 0 | 3 | 3 |
| 9 | U230E209 | Basics of Bioenergy and Biofuels | 3 | 0 | 0 | 3 | 3 |
| 10 | U230E210 | Food Science | 3 | 0 | 0 | 3 | 3 |
| 11 | U230E211 | Fundamentals of Crop Production | 3 | 0 | 0 | 3 | 3 |
| 12 | U230E212 | Water Pollution and Control Management | 3 | 0 | 0 | 3 | 3 |
| 13 | U230E213 | Personality Development | 3 | 0 | 0 | 3 | 3 |
| 14 | U230E214 | Workplace Communication | 3 | 0 | 0 | 3 | 3 |
| 15 | U230E215 | English for Competitive Examinations | 3 | 0 | 0 | 3 | 3 |
| 16 | U230E216 | English for Professional Excellence | 3 | 0 | 0 | 3 | 3 |
| 17 | U230E217 | Tools for Computing and Design Platform | 3 | 0 | 0 | 3 | 3 |
| 18 | U230E218 | Introduction to Sensors and Actuators | 3 | 0 | 0 | 3 | 3 |
| 19 | U230E219 | Underwater Communication | 3 | 0 | 0 | 3 | 3 |
| 20 | U230E220 | Consumer Electronics | 3 | 0 | 0 | 3 | 3 |
| 21 | U230E221 | Basics of Embedded Systems and IoT | 3 | 0 | 0 | 3 | 3 |
| 22 | U230E222 | Industrial Safety | 3 | 0 | 0 | 3 | 3 |
| 23 | U230E223 | Renewable Energy Technologies | 3 | 0 | 0 | 3 | 3 |
| 24 | U230E224 | Introduction to Smart Grid | 3 | 0 | 0 | 3 | 3 |
| 25 | U230E225 | Basics of Power Plant Engineering | 3 | 0 | 0 | 3 | 3 |
| 26 | U230E226 | Automotive Electronics | 3 | 0 | 0 | 3 | 3 |
| 27 | U230E237 | Nanomaterials and applications | 3 | 0 | 0 | 3 | 3 |
| 28 | U230E238 | Plastic Materials for Engineers | 3 | 0 | 0 | 3 | 3 |
| 29 | U230E239 | Production and Operations Management for Entrepreneurs | 3 | 0 | 0 | 3 | 3 |
| 30 | U230E240 | Quality Engineering | 3 | 0 | 0 | 3 | 3 |
| 31 | U230E241 | Reverse Engineering | 3 | 0 | 0 | 3 | 3 |

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| | | | | | |
|----------|---------------------------------|----------|----------|----------|----------|
| U23EN101 | TECHNICAL ENGLISH - I | L | T | P | C |
| | (Common to all branches) | 3 | 0 | 0 | 3 |

Prerequisites: Fundamentals of Analytical Skills in English

COURSE OBJECTIVES:

- To enhance reading comprehension skills for technical articles to grasp and interpret complex concepts.
- To prepare students' for effective communication and writing in technical and professional contexts.
- To develop the ability to write persuasive job applications and structured resumes effectively.

UNIT I INTRODUCTION 9

Reading – Requirement for Reading – reading short technical texts from journals and newspapers; **Writing** – Compare and Contrast Essay; Email Writing; **Grammar** – Parts of Speech, Mixed Tenses, Prepositional phrases; **Vocabulary Development** – Contextual meaning of words.

UNIT II READING AND LANGUAGE DEVELOPMENT 9

Reading – Reading Advertisements, User Manuals, Brochures; **Writing** - Process Writing, Interpreting charts & graphs; **Grammar** – Active and Passive Voice transformations, Infinitive and Gerunds; **Vocabulary Development** – Vocabulary used in formal & informal letters / emails and reports.

UNIT III TECHNICAL WRITING AND GRAMMAR 9

Reading – Reading Longer texts both general and technical, practice in speed reading; **Writing** – Writing responses to complaints, Letter to the Editor, Checklists, Problem solution essay / Argumentative Essay; **Grammar** – Error correction; If Clauses, Compound Words, Punctuation; **Vocabulary Development** – Sentence Completion.

UNIT IV REPORT WRITING 9

Reading – Reading for detailed comprehension: Skimming and Scanning; **Writing**- Recommendations, Writing Reports – Accident Report, Survey Report, Minutes of a meeting; **Grammar** – Reported Speech, Modals; **Vocabulary Development** – Technical Vocabulary.

UNIT V GROUP DISCUSSION AND JOB APPLICATIONS 9

Reading – Reading and understanding Technical Articles; **Writing** – Writing Job Application – Resume Preparation (via email and hard copy); **Grammar** – Numerical Adjectives, Relative Clauses, Idioms and Phrases; **Vocabulary Development** – Verbal Analogies.

TOTAL: 45 PERIODS

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TEXT BOOKS:

- 1 Veena Selvam, "English for Science and Technology", Cambridge University Press, 2021.
- 2 N P Sudharshana,m, C Saveetha, "English for Technical Communication", Cambridge University Press, New Delhi, 2016.

REFERENCES:

- 1 E Suresh Kumar, "Engineering English", Orient Black swan, Hyderabad, 2015.
- 2 Meenakshi Raman, Sangeetha Sharma, "Technical Communication Principles and Practice", Oxford University Press, New Delhi, 2014.
- 3 Marion Grussendorf, "English for Presentations", Oxford University Press, 2007.

ONLINE RESOURCES:

- 1 <https://iimskills.com/course/technical-writing-course/>
- 2 <https://www.udemy.com/course/easy-english-grammar-course>
- 3 <https://www.coursera.org/learn/introduction-to-research-for-essay-writing>

COURSE OUTCOMES:

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

- CO1** Write essays and emails.
CO2 Describe any process, interpretation of charts and graphs both general and technically.
CO3 Write letters and responses to complaints.
CO4 Write Recommendations, minutes and reports of events.
CO5 Write Job application with Resume.

CO - PO - PSO MAPPING:

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

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- 2 B S Grewal, "Higher Engineering Mathematics", 45th Edition, Khanna Publishers, 2018.

REFERENCES:

- 1 R K Jain, S R K Iyengar, "Advanced Engineering Mathematics", 6th Edition, Narosa Publications, 2021.
- 2 Ravish R Singh, Mukul Bhatt, "Advanced Engineering Mathematics", 2nd Edition, Tata McGraw Hill, 2020.
- 3 H C Taneja, "Advanced Engineering Mathematics", Dreamtech Press, 2019.
- 4 T K V Iyengar, M V A A N Prasad, B Krishna Gandhi, "Engineering Mathematics", Special Edition, S. Chand & Company Ltd., 2023.

ONLINE RESOURCES :

- 1 <http://nptel.ac.in/courses/111105035/10>
- 2 <http://nptel.ac.in/courses/111105035/5>
- 3 <http://nptel.ac.in/courses/111105035/17>

COURSEOUTCOMES:

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

- CO1** Apply Cayley-Hamilton theorem and orthogonal transformation for different process of matrices.
- CO2** Analyze the differentiation rules to find the extreme values of functions.
- CO3** Apply the concepts of partial derivatives and total derivatives in Taylor's series, Jacobians and maxima and minima of functions.
- CO4** Evaluate definite and improper integrals using techniques of integration
- CO5** Evaluate area and volume using double and triple integrals.

CO – PO – PSO MAPPING:

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

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|-----------------|---------------------------------|----------|----------|----------|----------|
| U23PH101 | ENGINEERING PHYSICS | L | T | P | C |
| | (Common to all branches) | 3 | 0 | 0 | 3 |

Prerequisites: Fundamentals of Mechanics and Optics

COURSE OBJECTIVES:

- To enable the students effectively understand concepts of mechanics and elastic properties of materials.
- To gain knowledge about thermal physics, ultrasonics, lasers, optical fibres with applications.
- To introduce the basics of quantum mechanics, crystal structures and imperfections.

UNIT I MECHANICS AND ELASTICITY 9

Center of mass (CM) – Rotational kinematics – Moment of Inertia (M.I.) – Theorems of M.I.: parallel and perpendicular axes theorems – M.I. of continuous bodies – Conservation of angular momentum – Elasticity – Hooke's law – Stress-Strain diagram – Poisson's ratio – Factors affecting elasticity – Bending moment – Depression of a cantilever – Young's modulus by uniform bending – I-shaped girders.

UNIT II THERMAL PHYSICS AND ULTRASONICS 9

Modes of heat transfer – Thermal conductivity – Newton's law of cooling – Lee's disc method – Radial heat flow – Rubber tube method – Characteristics and Production of ultrasonics by magnetostriction and piezoelectric methods – Acoustic grating – Non-destructive testing – Medical applications: Sonogram.

UNIT III LASERS AND FIBRE OPTICS 9

Laser: characteristics and properties – Einstein's coefficients derivation – Population inversion – Types of lasers: Nd-YAG laser, CO₂ laser, semiconductor laser – Applications of lasers – Principle and propagation of light in optical fibres – Numerical aperture and Acceptance angle – Classification of optical fibres (material, refractive index, mode) – Optical-fibre communication system (Block diagram only).

UNIT IV QUANTUM MECHANICS 9

Black body radiation – Photons and light waves – Electrons and matter waves – Compton effect: Theory and experimental verification – The Schrodinger equation: Time dependent and time independent forms – Physical significance of wave function – Particle in an infinite potential well: 1D – Electron microscopes: Scanning Electron Microscope and Transmission Electron Microscope.

UNIT V CRYSTAL PHYSICS 9

Lattice – Bravais lattice – Lattice planes – Miller indices – d-spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP crystal structures – Crystal imperfections: point, line and surface defects.

TOTAL: 45 PERIODS

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TEXT BOOKS:

- 1 D. Kleppner, R Kolenkow, "An Introduction to Mechanics", Tata McGraw Hill, 2017.
- 2 Arthur Beiser, Shobhit Mahajan, S Rai Choudhury, "Concepts of Modern Physics", Tata McGraw Hill, 2017.

REFERENCES:

- 1 R. Wolfson, "Essential University Physics", Volume 1 & 2, 4th Edition, Pearson Education, 2020.
- 2 K Thyagarajan, A Ghatak, "Lasers: Fundamentals and Applications", 2nd Edition, Laxmi Publication, 2019.
- 3 P K Palanisamy, "Materials Science", Scitech Publication India Pvt. Ltd., 2015.

ONLINE RESOURCES:

- 1 <https://www.coursera.org/courses?query=physics>
- 2 <https://archive.nptel.ac.in/courses/115/102/115102124/>
- 3 https://onlinecourses.nptel.ac.in/noc24_ph17/preview

COURSE OUTCOMES:

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

- CO1** Comprehend the basics of mechanics and elastic properties of materials.
CO2 Explain the thermal physics concepts, production and applications of ultrasonic waves.
CO3 Apply the basic concepts of lasers and optical fibre in various fields.
CO4 Describe the basics of quantum mechanical phenomenon and electron microscopes.
CO5 Explain the fundamentals of crystal structures and imperfections.

CO - PO - PSO MAPPING:

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

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U23CY101

ENGINEERING CHEMISTRY
(Common to all branches)

L T P C
3 0 0 3

Prerequisites: Fundamentals of Basic Chemistry

COURSE OBJECTIVES:

- To make the students conversant with water treatment techniques and the electrochemical reactions.
- To facilitate the understanding of fuel classification, preparation, combustion and environmental impact.
- To acquire a deep understanding of renewable energy sources and nano materials, their properties and applications.

UNIT I WATER AND ITS TREATMENT 9

Water: Sources and impurities, hardness, alkalinity. Boiler troubles: Scale and sludge. Treatment of boiler feed water: Internal treatment (sodium aluminate and calgon conditioning) and External treatment Ion exchange demineralization process, Municipal water treatment: primary treatment and disinfection (UV, Ozonation, break-point chlorination), Desalination of brackish water: Reverse Osmosis.

UNIT II ELECTRO CHEMISTRY AND DEVICE CORROSION 9

Electrochemistry: Introduction, Electrochemical cells – electrolytic cell – reversible and irreversible cells. Electrode potential – Oxidation and reduction Potentials – emf, Nernst equation and applications. Reference electrodes – Calomel electrode – Electro chemical series – its applications.

Device Corrosion: Introduction- chemistry of IC and PCB – causes of corrosion on IC, PC- miniaturization and complex material utilization- forms of corrosion – anodic and cathodic corrosion-Prevention of corrosion.

UNIT III FUELS AND COMBUSTION 9

Fuels: Introduction: Classification of fuels; Coal and coke: Analysis of coal (proximate and ultimate), Carbonization, Manufacture of metallurgical coke (Otto Hoffmann method), Petroleum and Diesel: Manufacture of synthetic petrol (Bergius process), Knocking – octane number, diesel oil – cetane number; Power alcohol and biodiesel.

Combustion of Fuels: Introduction: Calorific value – higher and lower calorific values, Theoretical calculation of calorific value; Flue gas analysis – ORSAT Method. CO₂ emission and carbon foot print.

UNIT IV ENERGY SOURCES AND STORAGE DEVICES 9

Solar energy conversion: Principle, working and applications of solar cells; recent developments in solar cell materials. Wind energy; Geothermal energy. Hydrogen as fuel: Sources of hydrogen – Hydrogen production methods – electrolysis, limitations and applications.

Storage Devices: Batteries – Types of batteries, Primary battery – dry cell, Secondary battery – lead acid battery and lithium – ion battery; Electric vehicles working principles.

UNIT V NANO CHEMISTRY 9

Basics: Distinction between molecules, nanomaterials and bulk materials; Types of nanomaterials: Definition, properties and uses of nano particles and nanotube. Preparation

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of nano materials: laser ablation, chemical vapours deposition, electrochemical deposition and electro spinning. An application of nanomaterials in medicine, agriculture, energy, electronics and catalysis.

TOTAL: 45 PERIODS

TEXT BOOKS:

- 1 Jain P C, Monica Jain, "Engineering Chemistry", 17th Edition, Dhanpat Rai Publishing Company Pvt. Ltd., New Delhi, 2021.
- 2 Chatla Naga Babu, G Kanthimathi, "Text Book of Engineering Chemistry", 1st Edition, AG Publishing House, 2023.

REFERENCES:

- 1 Reza K Haghi, Fransico Torrens, "Engineering Technology and Industrial Chemistry with Applications", Apple Academic Press, 2021.
- 2 Anna Klinkova, "Nano Chemistry", 1st Edition, Springer, 2023.
- 3 Stroud N, "Fundamentals of Engineering Chemistry", American Academic Publishers, 2023.

ONLINE RESOURCES:

- 1 https://onlinecourses.nptel.ac.in/noc22_ch27/preview
- 2 <https://nptel.ac.in/courses/105107207>
- 3 https://onlinecourses.nptel.ac.in/noc19_mm21/preview

COURSEOUTCOMES:

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

- C01** Describe the type of factors present in boilers and the method used to treat hard water.
- C02** Apply the principles of electrochemistry to corrosion process and the applications of protective coatings to overcome the corrosion.
- C03** Summarize the various solid, liquid and gaseous fuels manufacturing methods and basic reactions involved in combustion reaction.
- C04** Describe the types of batteries their reactions and the significance of storage renewable energy resource.
- C05** Apply the basic concepts of nanomaterials and its application in various sectors.

CO - PO - PSO MAPPING:

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

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U23CP101

PROGRAMMING IN C
(Common to all Branches)

L T P C
3 0 2 4

Prerequisites: Mathematical Fundamentals

COURSE OBJECTIVES:

- To understand the basic construct of C Language and develop C programming of these construct.
- To develop C program using arrays, strings and modular applications using functions.
- To develop applications in C using pointers, structures and union.

UNIT I BASICS OF C PROGRAMMING 9

Introduction to programming paradigms – Applications of C Language - Structure of C program – C programming: Data Types – Constants – Enumeration Constants – Keywords – Operators: Precedence and Associativity – Expressions – Input/ Output statements, Assignment statements. Illustrative Programs: Use of Variables in expression and their evaluation, Temperature Conversion (Fahrenheit to Celsius) Problem.

UNIT II DECISION MAKING AND LOOPING 9

Simple if Statements, The if.else statements, Nesting of if...else statements, else...if Ladder, switch Statements, goto Statements, while, do...while, for Statements , Illustrative Problems: EB Bill Computations, Determination of Average Cost and the range of the values , and Square root of a Series , Student Grade System.

UNIT III ARRAYS AND STRINGS 9

Introduction to Arrays: Declaration, Initialization – One dimensional array – Two dimensional arrays – String operations: length, compare, concatenate, copy – Selection sort, linear and binary search. Illustrative Programs: palindrome Checking using arrays and String, Concatenation of strings.

UNIT IV FUNCTIONS AND POINTERS 9

Modular programming - Function prototype, function definition, function call, Built-in functions (string functions, math functions) – Recursion, Binary Search using recursive functions – Pointers – Pointer operators, Parameter passing: Pass by value, Pass by reference. Illustrative Program: Fibonacci Series, Towers of Hanoi.

UNIT V STRUCTURES AND UNION 9

Structure - Nested structures – Array of structures – Self-referential structures – Dynamic memory allocation - Singly linked list – typedef – Union - Storage classes and Visibility. Illustrative Program: To Print name and address of Employee, Generate Student Mark List.

45 PERIODS

PRACTICAL EXERCISES:

1. I/O statements, operators, expressions.
2. Decision-making constructs: if-else, goto, switch-case, break-continue.
3. Loops: for, while, do-while
4. Arrays: 1D and 2D, multi-dimensional arrays, traversal.
5. Strings: operations.

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6. Functions and Pointers: Passing parameters by (value, reference), passing arrays to function, Recursion using pointers.
7. Structures and Unions: Nested Structures, Arrays of Structures and Unions

30 PERIODS
TOTAL: 75 PERIODS

TEXT BOOKS:

- 1 Reema Thareja, "Programming in C", Oxford University Press, 2nd Edition, 2018.
- 2 Brian W Kernighan, Dennis M Ritchie, "The C Programming language", 3rd Edition, Prentice Hall of India, 2019.

REFERENCES:

- 1 Paul Deitel, Harvey Deitel, "C How to Program with an Introduction to C++", 8th Edition, Pearson Education, 2018.
- 2 Yashwant Kanetkar, "Let us C", 17th Edition, BPB Publications, 2020.
- 3 Pradip Dey, Manas Ghosh, "Computer Fundamentals and Programming in C", 2nd Edition, Oxford University Press, 2013.
- 4 Anita Goel, Ajay Mittal, "Computer Fundamentals and Programming in C", 1st Edition, Pearson Education, 2016.

ONLINE RESOURCES:

- 1 https://onlinecourses.nptel.ac.in/noc22_cs40/preview
- 2 https://onlinecourses.swayam2.ac.in/cec24_cs05/preview
- 3 https://onlinecourses.swayam2.ac.in/nou24_cs06/preview

COURSE OUTCOMES:

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

- CO1** Describe knowledge on C Programming constructs.
- CO2** Apply the simple applications in C using decision making and looping.
- CO3** Design the various applications using arrays and strings.
- CO4** Write and implement modular applications in C using functions and Pointers.
- CO5** Apply the User defined concept in C using Structures and Unions.

CO - PO - PSO MAPPING:

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

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|----------|---|----------|----------|----------|----------|
| U23BE104 | BASIC ELECTRICAL AND ELECTRONICS ENGINEERING | L | T | P | C |
| | (Common to CSE, IT, AIDS & CSE (CS)) | 3 | 0 | 0 | 3 |

Prerequisites: Engineering Physics

COURSE OBJECTIVES:

- To understand and gain the knowledge of Electric Circuits and Analysis.
- To understand and gain the knowledge of Electrical Machines and its Applications.
- To understand and gain the knowledge of Analog Devices, Digital Electronics and Measuring Instruments.

UNIT I ELECTRICAL CIRCUITS 9

DC Circuits: Ohm's Law – Kirchhoff's Laws – Simple problems – Nodal Analysis, Mesh analysis with independent sources only, AC Circuits: Average value – RMS Value- Instantaneous power, real power, reactive power and apparent power- power factor.

UNIT II ELECTRICAL MACHINES 9

DC Generator: Construction and Working principle – EMF equation – Types – Applications, DC motor: Working Principle – Torque Equation – Types – Applications, Transformer: Construction – Working principle – Types – Applications, Induction motor: Construction and Working principle of Single phase and Three phase Induction motor-Types – Applications.

UNIT III ANALOG ELECTRONICS 9

Semiconductor Materials – Operation and Characteristics of PN Junction Diodes, Zener Diode, Bipolar Junction Transistors, JFET, MOSFET – Half wave and Full wave Rectifier circuits.

UNIT IV DIGITAL ELECTRONICS 9

Review of Number Systems –Representation of logic functions – SOP and POS forms- minimization using K maps (Simple Problems only) – Combinational logic circuits: Adder and Subtractor.

UNIT V MEASUREMENTS AND INSTRUMENTATION 9

Elements of a generalized measurement system – Static and Dynamic Characteristics – Classification of instruments – moving coil and moving iron meters – Dynamometer type watt meters – Induction type Energy meter – Measurement of Resistances using Megger – DSO.

TOTAL: 45 PERIODS

TEXT BOOKS:

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

REFERENCES:

- 1 Thomas L Floyd, "Digital Fundamentals", 11th Edition, Pearson Education, 2017.

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- 2 Kothari D P, I J Nagrath, "Basic Electrical Engineering", 4th Edition, Tata McGraw Hill, 2019.
- 3 Sedha R S, "A text book of Applied Electronics", S Chand & Co., 2017.

ONLINE RESOURCES:

- 1 <https://nptel.ac.in/courses/108105112>.
- 2 <https://www.udemy.com/course/basic-electrical-engineering-electrical-engineering>.
- 3 <https://www.coursera.org/learn/electronics>.

COURSE OUTCOMES:

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

- CO1** Solve the circuits using basic electrical theorems.
- CO2** Explain the working principle and applications of electrical machines.
- CO3** Summarize the characteristics of Analog electronic devices.
- CO4** Explain the basic concepts of Digital Electronics.
- CO5** Describe the operating principles of measuring instruments.

CO - PO - PSO MAPPING:

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

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U23TA101

தமிழர் மரபு
(Common to all Branches)

L T P C
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நோக்கம்:

- பாரம்பரியக் கலாச்சாரத்தின் நுண்ணறிவையும் மற்றும் கட்டிடக்கலையின் அற்புதங்களில் நடைபெறும் பொறியியல் நுட்பங்களை எடுத்துரைப்பதாகும்.
- தமிழ்மொழி, பண்பாடு, கலைகள், மரபுகளின் வரலாற்றைப் பற்றி எடுத்துரைப்பதன் நோக்கமாகும்.
- அந்தணர்க்கும் அரசர்க்கும் கல்வியையும், வணிகர்களுக்கு வியாபாரத்தையும், வேளாண் மக்களுக்கு உழவுத்தொழிலையும் தமிழர் மரபின் எடுத்துரைப்பதாகும்.

அலகு - 1 மொழி மற்றும் இலக்கியம் 3
இந்திய மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை - சங்க இலக்கியத்தில் பகிர்தல் அறம் - திருக்குறளில் மேலாண்மைக் கருத்துக்கள் - தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் - பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

அலகு - 2 மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக் கலை 3

நடுகல் முதல் நவீன சிற்பங்கள் வரை - ஐம்பொன் சிலைகள் - பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் - தேர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புறத் தெய்வங்கள் - குமரிமுனையில் திருவள்ளூர் சிலை - இசைக் கருவிகள் - மிருதங்கம், பறை, வீணை, யாழ், நாத்தஸ்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

அலகு - 3 நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள் 3

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஓயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

அலகு - 4 தமிழர்களின் திணைக்கோட்பாடுகள் 3

தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்க காலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்ககால நகரங்களும் துறை முகங்களும் - சங்க காலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.

அலகு - 5 இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு 3

இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறபகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுய மரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிக்கல் - தமிழ்ப் புத்தகங்களின் அச்ச வரலாறு.

TOTAL: 15 PERIODS

TEXT BOOKS:

- முனைவர் ஆ. பூபாலன் "தமிழர் மரபு", வி.ஆர்.பி. வெளியீடு புதிய பாடத்திட்டம் 2023 - 24 அண்ணா பல்கலைக்கழகம்.

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2. முனைவர் ஆ. ஹேமமாலினி “தமிழர் மரபு”, வி.ஆர்.பி. வெளியீடு புதிய பாடத்திட்டம் 2023 – 24 அண்ணா பல்கலைக்கழகம்.

REFERENCES:

1. முனைவர் கே.கே. பிள்ளை “தமிழக வரலாறு, மக்களும், பண்பாடும்,” வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம், 1972.
2. முனைவர் இல. சுந்தரம், “பொருதை, ஆற்றங்கரை நாகரிகம்,” வெளியீடு: தொல்லியல் துறை மற்றும் தமிழ்நாடு அரசுத் துறை, 2022.
3. Dr. S. V. சுப்பிரமணியன், னுச.மு.ஐ. திருநாவுக்கரசு “தமிழர்களின் வரலாற்று பாரம்பரியம்”, சர்வதேச தமிழ் ஆய்வு நிறுவனம், 2022.

ONLINE RESOURCES:

1. <https://unacademy.com/lesson/introduction-and-administrative-system-of-cultural-heritage-of-tamil-in-tamil/ATMT6TK4>
2. <https://unacademy.com/lesson/society-and-sangam-literature-in-tamil/C5QL4L0Q>
3. <https://unacademy.com/lesson/classical-tamil-literature-epigraphy-and-hero-stones-in-tamil/817FIREX>

COURSE OUTCOMES:

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

- CO1 மொழிகள், இலக்கியங்கள் மற்றும் காப்பியங்கள் பற்றி தொகுக்க இயலும்.
Summarize about languages, literatures and scripts.
- CO2 நடுகற்கள், நவீன சிற்பங்கள், ஐம்பொன் சிலைகள், மற்றும் இசைக் கருவிகள் பற்றி விளக்க இயலும்.
Explain middle stone, modern sculptures, panchaloga idols and musical instruments.
- CO3 நாட்டுப்புறத் தெய்வங்கள், கலைகள் மற்றும் வீர விளையாட்டுகள் பற்றி விளக்க இயலும்.
Explain about the folk gods, arts and heroic sports.
- CO4 தமிழர்களின் திணைக்கோட்பாடுகள் பற்றி தொகுக்க இயலும்.
Summarize the political theories of tamils.
- CO5 இந்திய தேசிய இயக்கம், மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு பற்றி தொகுக்க இயலும்.
Summarize Indian national movement contribution of Tamils to Indian culture.

CO – PO – PSO MAPPING:

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

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U23PC101

PHYSICS AND CHEMISTRY LABORATORY

L T P C

(Common to all branches)

0 0 3 1.5

Prerequisites: Principles of Physics and Chemistry

COURSE OBJECTIVES:

- To provide an experimental foundation for the theoretical concepts introduced in the lectures.
- To teach how to make careful experimental observations and how to think about and draw conclusions from such data.
- To help students understand the role of direct observation in physics and chemistry to distinguish between inferences based on theory and the outcomes of experiments.

PHYSICS LABORATORY

LIST OF EXPERIMENTS (Any FIVE Experiments)

1. Determination of Young's modulus by Non uniform bending method.
2. Determination of Rigidity modulus of wire and moment of inertia using torsional pendulum.
3. Determination of Young's modulus by Simple harmonic oscillations of cantilever.
4. Determination of Wavelength of the Laser using grating.
5. Determination of Numerical aperture and acceptance angle in an optical fiber.
6. Determination of velocity of sound and compressibility of liquid –Ultrasonic Interferometer.
7. Determination of thickness of a thin sheet of wire–Air wedge.

CHEMISTRY LABORATORY

LIST OF EXPERIMENTS (Any FIVE Experiments)

1. Determination of total, temporary and permanent hardness of water by EDTA method.
2. Determination of chloride content of water sample by Argentometric method.
3. Determination of alkalinity in water sample.
4. Preparation of nanoparticles (TiO₂/ZnO/CuO) by Sol-Gel method.
5. Determination of strength of given hydrochloric acid using pH meter.
6. Conductometric titration of strong acid Vs strong base.
7. Conductometric titration of barium chloride Vs sodium sulphate.
8. Estimation of iron content of the given solution by using potentiometer.

TOTAL: 45 PERIODS

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COURSE OUTCOMES:

- CO1** Calculate the Young's modulus by non-uniform bending, simple harmonic oscillations by Torsion Pendulum.
- CO2** Calculate the thickness of a thin wire by air wedge and velocity of sound, compressibility of liquid using ultra sonic interferometer.
- CO3** Calculate the wavelength, acceptance angle and numerical aperture using laser.
- CO4** Estimate the amount of Hardness, chloride, alkalinity in water samples.
- CO5** Estimate the amount of acid, iron content present in a given solution by using pH, conductivity and potentiometric titration.

CO - PO - PSO MAPPING:

| | P01 | P02 | P03 | P04 | P05 | P06 | P07 | P08 | P09 | P010 | P011 | P012 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | 3 | 2 | 1 | 1 | - | - | - | 1 | 1 | 2 | - | 1 |
| CO2 | 3 | 2 | 1 | 1 | - | - | - | 1 | 1 | 2 | - | 1 |
| CO3 | 3 | 2 | 1 | 1 | - | - | - | 1 | 1 | 2 | - | 1 |
| CO4 | 3 | 3 | 1 | 3 | - | - | - | 1 | 1 | 2 | - | 1 |
| CO5 | 3 | 3 | 1 | 3 | - | - | - | 1 | 1 | 2 | - | 1 |

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U23EN102

PROFESSIONAL COMMUNICATION LABORATORY
(Common to all branches)

L T P C
0 0 3 1.5

Prerequisites: Basic Communication Skills

COURSE OBJECTIVES:

- To enhance their employability and career prospects by equipping them with soft skills.
- To emphasize the importance of interview etiquette and prepare for job interviews.
- To cultivate a general awareness of current affairs to engage in a professional world.

UNIT I

Introduction to basic Communication Skills of learning – Listening – Empathetic Listening- Key role in Organizational communication; Speaking – role plays – asking about routine actions and expressing opinions. 9

UNIT II

Introduction to Soft Skills – Hard skills & soft skills - employability and career Skills – Grooming as a professional with values – Time Management – General awareness of Current Affairs. 9

UNIT III

Self-Introduction-organizing the material - Introducing oneself to the audience – introducing the topic – answering questions – individual presentation practice – presenting the visuals effectively – 5 minute presentations. 9

UNIT IV

Introduction to Group Discussion – Participating in group discussions – understanding group dynamics – brainstorming the topic – questioning and clarifying – GD strategies- activities to improve GD skills. 9

UNIT V

Interview etiquette – dress code – body language – attending job interviews – telephone/Skype interview -one to one interview & panel interview – FAQs related to job interviews. 9

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO1** Apply communication proficiency by mastering empathetic listening and speaking skills.
- CO2** Apply soft skills fostering comprehensive competence.
- CO3** Apply effective techniques to deliver presentations in all aspects.
- CO4** Apply effective strategies for active participation in Group Discussion.
- CO5** Apply interview etiquette to navigate various interview formats for Job Interviews.

CO – PO – PSO MAPPING:

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

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U23EN201

TECHNICAL ENGLISH - II
(Common to all branches)

L T P C
3 0 0 3

Prerequisites: Basics of Communication discourse

COURSE OBJECTIVES:

- To develop a high level of proficiency in the English language, encompassing LSRW skills to engage effectively.
- To equip students with a strong foundation in English grammar and vocabulary to understand technical texts.
- To foster critical thinking skills including the ability to evaluate texts critically.

UNIT I GENERAL READING AND FREE WRITING 9

Listening –Short texts (Listening to Audio & Video) Types of Listening – formal and informal conversations – Telephone conversation; Listening to voicemail & messages; **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, developing hints, Note – Making; **Grammar** – Tenses; **Vocabulary Development** – Word Formation.

UNIT II LISTENING AND SUMMATION 9

Listening – Listening to podcasts / anecdotes / event narration, documentaries and interviews with celebrities; **Speaking** – Narrating personal experiences / events / Reporting and summarizing documentaries / podcasts / interviews; **Reading** – Reading biographies, travelogues, newspaper reports, Excerpts from literature and travel & technical blogs. **Writing** –Short Report on an event (field trip etc.) **Grammar** – Question types: Wh / Yes or No; **Vocabulary Development** – One word substitution.

UNIT III SPEAKING AND ANALYSIS SKILLS 9

Listening – Dialogues & Conversations, focused audio track – **Speaking** – Role Play – Asking about routine actions and Expressing Opinions – Group Interaction – Speaking in formal situations (teachers, officials, foreigners); **Reading** – Reading longer texts & Making a Critical Analysis of the given text; **Writing** – Types of Paragraphs and Essays – Rearrangement of Jumbled sentences; **Grammar** - Cause & Effect Expressions; **Vocabulary Development** – Synonyms & Antonyms.

UNIT IV READING AND LANGUAGE PROGRESSION 9

Listening – Listening to Dialogues or conversations and completing exercises based on them; **Speaking** – Speaking about one – speaking about one’s friend; **Reading** – Comprehension, Reading Different Types of Texts – magazines; **Writing** – Letter Writing - formal or informal letters – E Mails – Conventions of personal email; **Grammar** – Discourse Markers (connectives & sequence words); **Vocabulary development** – Homonyms and Homophones.

UNIT V COMPREHENSIVE WRITING 9

Listening –Listening to Speeches / Presentations, Listening to broadcast and telecast from

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Radio and TV; **Speaking** – Participating in Conversations – short group conversations – Making presentations on given topics; **Reading** –Email communication – Reading the attachment files having a poem / joke / proverb; **Writing** – Creative writing, Poster making, dialogue writing; **Grammar** – Degrees of Comparison, Fixed / Semi-Fixed Expressions; **Vocabulary Development** Abbreviations & Acronyms (as used in technical contexts).

TOTAL: 45 PERIODS

TEXT BOOKS:

- 1 Venkatraman G, "Effective Technical Communication" 1st Edition, Pearson Education, 2022.
- 2 Lakshminarayanan K R, "English for Communication", Scitech Publications, 2022.

REFERENCES:

- 1 Raman, Meenakshi, Sharma, Sangeetha, "Technical Communication Principles and Practice", Oxford University Press, New Delhi, 2015.
- 2 Sharma Sangeetha, Mishra Binod, "Communication Skills for Engineers and Scientists", 2nd Edition, Prentice Hall of India, 2023.
- 3 Ruchi Agarwal, "Academic Writing for Students: A Practical Guide", Eliva Press, 2024.

ONLINE RESOURCES:

- 1 https://onlinecourses.nptel.ac.in/noc22_hs05/preview
- 2 <https://www.coursera.org/specializations/creative-writing>
- 3 <https://www.coursera.org/courses-writing>

COURSE OUTCOMES:

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

- CO1** Apply the concepts of writing in an effective way.
CO2 Write concise reports in a professional context.
CO3 Write different kinds of Paragraphs and Essays.
CO4 Write Email and formal / informal letters without grammatical errors.
CO5 Analyze collaborative work through writing process.

CO – PO – PSO MAPPING:

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

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|-----------------|--|----------|----------|----------|----------|
| U23MA201 | VECTOR CALCULUS AND COMPLEX FUNCTIONS | L | T | P | C |
| | (Common to all branches) | 3 | 1 | 0 | 4 |

Prerequisites: Engineering Mathematics

COURSE OBJECTIVES:

- To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model engineering problems
- To make the students to understand the vector calculus such as divergence, curl needed, for problems in all engineering disciplines.
- To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, in application areas.

UNIT I **DIFFERENTIAL EQUATIONS** **12**

Higher order linear differential equations with constant coefficients – Method of variation of parameters – Linear differential equation with variable coefficients – Euler’s and Legendre’s type – System of simultaneous linear differential equations with constant coefficients – Undetermined coefficients.

UNIT II **BASICS OF VECTOR CALCULUS** **12**

Gradient and directional derivative – Divergence and curl – Vector identities – Irrotational and solenoidal vector fields – Work done by a force – Conservative force field.

UNIT III **APPLICATIONS OF VECTOR CALCULUS** **12**

Line integral over a plane curve – Surface integral – Area of a curved surface – Volume integral – Green’s, Gauss divergence and Stoke’s theorems – Verification and application in evaluating line, surface and volume integrals.

UNIT IV **ANALYTIC FUNCTIONS** **12**

Analytic functions – Necessary and sufficient conditions for analyticity in cartesian and polar coordinates – Properties – Harmonic conjugates – Construction of analytic function – Conformal mapping – Mapping by functions $(z + a, az, z^2, 1/z)$ – Bilinear transformation

UNIT V **COMPLEX INTEGRATION** **12**

Line integral – Cauchy’s integral theorem – Cauchy’s integral formula – Taylor’s and Laurent’s series – Singularities – Residues – Residue theorem – Application of residue theorem for evaluation of real integrals – Use of circular contour and semi – circular contour (without poles on real axis).

TOTAL: 60 PERIODS

TEXT BOOKS:

- 1 B S Grewal, “Higher Engineering Mathematics”, Khanna Publishers, 45th Edition, 2020.
- 2 E. Kreyszig, “Advanced Engineering Mathematics”, John Wiley & Sons, 10th Edition, 2020.

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REFERENCES:

- 1 H K Dass, "Advanced Engineering Mathematics", S. Chand & Company Ltd., 20th Edition, 2019.
- 2 Ravish R Singh, Mukul Bhatt, "Advanced Engineering Mathematics", 2nd Edition, Tata McGraw Hill, 2020.
- 3 H C Taneja, "Advanced Engineering Mathematics", Dreamtech Press, 2019.
- 4 T K V Iyengar, M V A A N Prasad, B Krishna Gandhi, "Engineering Mathematics", Special Edition, S. Chand & Company Ltd., 2023.

ONLINE RESOURCES:

- 1 <https://nptel.ac.in/courses/111105134>
- 2 <https://nptel.ac.in/courses/111107111>
- 3 <https://nptel.ac.in/courses/111103070>

COURSE OUTCOMES:

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

- CO1** Solve higher order differential equations of different types for engineering applications.
- CO2** Explain the concepts of vector calculus.
- CO3** Evaluate line, surface and volume integrals in various vector fields using Greens, Stokes and Gauss theorems.
- CO4** Analyze the properties and mappings for constructing analytic functions.
- CO5** Evaluate the complex and contour integral using Cauchy's theorem.

CO - PO - PSO MAPPING:

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

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U23PH203 **PHYSICS FOR COMPUTER TECHNOLOGY** **L T P C**
Prerequisites: Engineering Physics **3 0 0 3**

COURSE OBJECTIVES:

- To make the students gain knowledge on conducting materials and semiconducting materials.
- To instil knowledge on physics of magnetic and superconducting materials.
- To inculcate an idea of significance of optoelectronic devices, new engineering materials and their applications.

UNIT I **CONDUCTING MATERIALS** **9**

Conductors – Classical free electron theory of metals–Electrical and thermal conductivity – Wiedemann – Franz law – Lorentz number – Success and failures of classical theory – Quantum theory – Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – Carrier concentration in metals – Energy bands in solids.

UNIT II **SEMICONDUCTING MATERIALS** **9**

Intrinsic semiconductor – Carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – Compound semiconductors – Direct and indirect band gap – n-type and p-type semiconductor: derivation of carrier concentration – Variation of Fermi level with temperature and impurity concentration – Hall effect – Determination of Hall coefficient – Experimental verification of Hall-effect – Applications.

UNIT III **MAGNETIC AND SUPERCONDUCTING MATERIALS** **9**

Origin of magnetic moment – Magnetic properties of Dia, Para, Ferro, anti-Ferro and ferrite materials – Domain theory – Hysteresis – Soft and hard magnetic materials – Superconductivity: properties – Type I and Type II superconductors – BCS theory of superconductivity (Qualitative) – High temperature superconductors – Applications of superconductors: SQUID, Cryotron, Magnetic levitation.

UNIT IV **OPTICAL MATERIALS** **9**

Classification of optical materials – Carrier generation and recombination processes – Absorption, emission and scattering of light in metals, insulators and semiconductors (concepts) – Opto electronic devices: light detectors and solar cells – Light emitting diode (LED) – Organic LED – Laser diodes – Optical data storage techniques.

UNIT V **NEW ENGINEERING MATERIALS** **9**

Shape memory alloys (SMA): Characteristics, properties of NiTi alloy and application – Metallic glasses: properties, preparation and applications – Nanomaterials: properties – preparation: top-down and bottom-up approach – Quantum structures: Q-dot, Q-wire, Q-well – Carbon Nano tubes (CNT): properties and applications.

TOTAL: 45 PERIODS

TEXT BOOKS:

- 1 S O Kasap, "Principles of Electronic Materials and Devices ", Tata McGraw Hill, 2020.

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- Donald A Neamen, "Semiconductor Physics and Devices Basic Principles", Jain Book Agency, 2024.

REFERENCES:

- Y Slimani, E Hannachi, "Super Conducting Materials, Fundamentals, Synthesis and Applications", Springer, 2022.
- Kelly S Potter, Joseph Simmons, "Optical Materials", 2nd Edition, Elsevier, 2021.
- Visakh P M, Artem Semkin, R Balakrishnan, S Lazovic, "Nanotechnology in Electronics: Materials, Properties, Devices", John Wiley & Sons, 2022.

ONLINE RESOURCES:

- https://onlinecourses.nptel.ac.in/noc24_ph05/preview
- https://onlinecourses.nptel.ac.in/noc24_ph02/preview
- https://onlinecourses.nptel.ac.in/noc21_ph14/preview

COURSE OUTCOMES:

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

- CO1** Explain the properties of conducting materials based on free electron theories.
CO2 Describe the types of semiconducting materials and its applications.
CO3 Summarize the magnetic and superconducting properties of materials and its uses.
CO4 Apply the various optical phenomena in optoelectronic devices.
CO5 Explain the characteristics, preparations and applications of new engineering materials.

CO - PO - PSO MAPPING:

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

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U23EG101

ENGINEERING GRAPHICS
(Common to all branches)

L T P C
2 0 4 4

Prerequisites: Nil

COURSE OBJECTIVES:

- To prepare the students for drawing freehand sketch of simple objects and engineering curves.
- To prepare the students for drawing orthographic projection of solids, section of solids and development of lateral surfaces of various solids.
- To prepare the students for drawing pictorial projections like isometric and perspective projection of simple solids.

UNIT I

PLANE CURVES

6+12

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

UNIT II

PROJECTION OF POINTS, LINES AND PLANE SURFACES

6+12

Orthographic projection- principles – Principal planes – First angle projection-projection of points. 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 AND FREE HAND SKETCHING

6+12

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

SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES

6+12

Sectioning of simple solids in 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 sectioned solids (without Cut out) — Prisms, pyramids cylinders and cones.

UNIT V

ISOMETRIC AND PERSPECTIVE PROJECTIONS

6+12

Principles of isometric projection — isometric scale - isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.

TOTAL: 90 PERIODS

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TEXT BOOKS:

- 1 Bhatt N D, Panchal V M, "Engineering Drawing", Charotar Publishing House, 54th Edition, 2023.
- 2 Natrajan K V, "A Text Book of Engineering Graphics", 36th Edition, Dhanalakshmi Publishers, 2023.

REFERENCES:

- 1 Gopalakrishna K R, "Engineering Drawing" (Vol. I&II Combined), Subhas Publications, 27th Edition, 2017.
- 2 Venugopal K. and Prabhu Raja V, "Engineering Graphics", New Age International Private Limited, 2008.
- 3 Parthasarathy N S, Vela Murali, "Engineering Graphics", Oxford University Press, 2015.
- 4 Basant Agarwal and Agarwal C. M, "Engineering Drawing", Tata McGraw Hill, 2nd Edition, 2019.

ONLINE RESOURCES:

- 1 <https://archive.nptel.ac.in/courses/112/102/112102304/>
- 2 <https://nptel.ac.in/courses/112103019>
- 3 https://onlinecourses.nptel.ac.in/noc24_ar02/preview

COURSE OUTCOMES:

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

- CO1** Draw the various curves used in engineering practices.
- CO2** Draw the projections of straight lines which are inclined to both the planes.
- CO3** Draw the projections of solids inclined to one plane and parallel to other plane.
- CO4** Draw the projections of sectioned solids and draw the development of lateral surfaces of a solid.
- CO5** Draw the isometric projections and perspective projections of simple solids.

CO - PO - PSO MAPPING:

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

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| | | | | | |
|----------|---|----------|----------|----------|----------|
| U23PY201 | PROBLEM SOLVING AND PYTHON PROGRAMMING | L | T | P | C |
| | (Common to all Branches) | 3 | 0 | 2 | 4 |

Prerequisites: Programming in C

COURSE OBJECTIVES:

- To understand the basics of algorithmic problem solving using Python conditionals and loops
- To define Python functions and use function calls to solve problems.
- To use Python data structures - lists, tuples, dictionaries to represent complex data and to input/output with files in Python.

UNIT I COMPUTATIONAL THINKING AND PROBLEM SOLVING 9

Fundamentals of Computing – Identification of Computational Problems - Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion), Towers of Hanoi, insert a card in a list of sorted cards.

UNIT II DATA TYPES, EXPRESSIONS, STATEMENTS 9

Python interpreter and interactive mode, debugging; values and types: int, float, Boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points,

UNIT III CONTROL FLOW, FUNCTIONS, STRINGS 9

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, Strings: string slices, immutability, string functions and methods, Lists as arrays, linear search, binary search.

UNIT IV LISTS, TUPLES, DICTIONARIES 9

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing; Illustrative programs: histogram, Retail bill preparation, sorting.

UNIT V FILES, MODULES, PACKAGES 9

Files and exceptions: text files, reading and writing files, format operator; errors and exceptions, handling exceptions, modules, packages; Illustrative programs: GCD, setting offset in a file, wordcount, copyfile, voter's age, validation, marks range validation.

45 PERIODS

PRACTICAL EXERCISES:

- 1 Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same. (Electricity Billing, Retail shop billing)
- 2 Python programming using simple statements and expressions (exchange the values of two variables, compute Simple Interest).
- 3 Scientific problems using Conditionals and Iterative loops. (Prime factor of an Integer, Bin to Decimal, Octal and Hexa).
- 4 Implementing programs using Functions. (Factorial, largest number in alist).
- 5 Implementing programs using Strings. (Reverse, palindrome, character count, replacing characters).
- 6 Implementing operations of lists, tuples, and dictionaries.

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- 7a Implementing operations of file handling. (Copy from one file to another, word count).
 7b Implementing real-time/technical applications using Exception handling. (Divide by zero error, voter's age validity, student mark range validation).

30 PERIODS
TOTAL: 75 PERIODS

TEXT BOOKS:

- 1 Allen B Downey, "Think Python: How to Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016.
- 2 Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and Programming", 1st Edition, BCS Learning & Development Limited, 2017.

REFERENCES:

- 1 Paul Deitel, Harvey Deitel, "Python for Programmers", 1st Edition, Pearson Education, 2021.
- 2 G Venkatesh, Madhavan Mukund, "Computational Thinking: A Primer for Programmers and Data Scientists", 1st Edition, Notion Press, 2021.
- 3 John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modelling and Understanding Data", 3rd Edition, MIT Press, 2021
- 4 Eric Matthes, "Python Crash Course, A Hands-on Project Based Introduction to Programming", 2nd Edition, No Starch Press, 2019.
- 5 Martin C Brown, "Python: The Complete Reference", 4th Edition, Tata McGraw Hill, 2018.

ONLINE RESOURCES

- 1 <http://www.digimat.in/nptel/courses/video/106106212/L01.html>
- 2 https://onlinecourses.swayam2.ac.in/cec24_cs03/preview
- 3 https://onlinecourses.swayam2.ac.in/cec24_cs01/preview

COURSE OUTCOMES:

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

- CO1** Solve simple computational problems using notations.
CO2 Write python programs using statements and Expressions.
CO3 Apply control flow and functional concepts in a user define problems.
CO4 Apply python data structures - list, tuples and dictionaries for compound data.
CO5 Describe file handling and exceptional handling in python for solving problems.

CO - PO - PSO MAPPING

| | P01 | P02 | P03 | P04 | P05 | P06 | P07 | P08 | P09 | P010 | P011 | P012 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | 3 | 2 | 1 | 2 | - | - | - | 1 | 1 | 1 | - | 1 |
| CO2 | 3 | 3 | 3 | 3 | 1 | - | - | 1 | 1 | 1 | - | 1 |
| CO3 | 3 | 2 | 1 | 2 | 1 | - | - | 1 | 1 | 1 | - | 1 |
| CO4 | 3 | 2 | 1 | 2 | 1 | - | - | 1 | 1 | 1 | - | 1 |
| CO5 | 2 | 2 | 1 | 1 | 1 | - | - | 1 | 1 | 1 | - | 1 |

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U23CS201

DATA STRUCTURES

L T P C

Prerequisites: C Programming

3 0 0 3

COURSE OBJECTIVES:

- To understand the concepts of linear and non-linear data structures.
- To understand and gain the knowledge of sorting, searching and hashing algorithms.
- To apply Tree and Graph data structures.

UNIT I

LIST

9

Abstract Data Types (ADTs) – List ADT – Array-based implementation – Linked list implementation – Singly linked lists – Circularly linked lists – Doubly-linked lists – Applications of lists – Polynomial ADT – Radix Sort – Multilists.

UNIT II

STACKS AND QUEUES

9

Stack ADT – Operations – Applications – Balancing Symbols – Evaluating arithmetic expressions – Infix to Postfix conversion – Function Calls – Queue ADT – Operations – Circular Queue – DeQueue – Applications of Queues.

UNIT III

TREES

9

Tree ADT – Tree Traversals – Binary Tree ADT – Expression trees – Binary Search Tree ADT – AVL Trees – Priority Queue (Heaps) – Binary Heap.

UNIT IV

MULTIWAY SEARCH TREES AND GRAPHS

9

B-Tree – B+ Tree – Graph Definition – Representation of Graphs – Types of Graph Breadth – first traversal – Depth-first traversal

UNIT V

SORTING AND SEARCHING

9

Searching – Linear Search – Binary Search. Sorting – Bubble sort – Selection sort – Insertion sort – Shell sort – Merge Sort – Hashing – Hash Functions – Separate Chaining

TOTAL: 45 PERIODS

TEXT BOOKS:

- 1 Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education, 2020.
- 2 Lovelyn Rose, "Data Structures", 2nd Edition, Wiley & Sons, 2019.

REFERENCES:

- 1 Yedidyah Langsam, Aaron M Tenenbaum, "Data Structures Using C and C++", 2nd Edition, Pearson Education, 2015.
- 2 Thomas H Cormen, Charles E Leiserson, Ronald L Rivest, Clifford Stein, "Introduction to Algorithms", 4th Edition, Tata McGraw Hill, 2022.

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- 3 Kruse, "Data Structures and Program Design in C", 2nd Edition, Pearson Education, 2006.

ONLINE RESOURCES:

- 1 <https://www.coursera.org/learn/data-structures>.
- 2 https://onlinecourses.swayam2.ac.in/nou24_cs06/preview.
- 3 <https://www.mygreatlearning.com/academy/learn-for-free/courses/data-structures-in-c>

COURSE OUTCOMES:

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

- CO1** Describe abstract data types for linear data structures.
CO2 Explain Stack, Queue ADT's operations and its applications.
CO3 Apply various algorithms of tree data structures for solving real world problems.
CO4 Apply appropriate graph algorithm for solving a given problem.
CO5 Analyse various searching, sorting and hashing techniques.

CO - PO - PSO MAPPING:

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

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U23TA201

தமிழரும் தொழில்நுட்பமும்
(Common to all Branches)

L T P C
1 0 0 1

நோக்கம்:

- அறிவியல் மற்றும் பொறியியல் சார்ந்த அறிவுத்திறனைப் பெருக்குவதன் மூலம் உலக அளவில் அவர்களின் தரத்தை உயர்த்துவதன் நோக்கமாகும்.
- தமிழர் தொழில்நுட்பம் ஏனைய நாகரிகங்களுக்கு இணையான வளர்ச்சியைக் கொண்டதே இதன் நோக்கமாகும்.
- வேளாண்மை, கட்டிடக்கலை, இசைக்கருவிகள், கப்பற்கலை, போர்க்கலை என பல துறைகளில் தமிழர் தொழில்நுட்பத்தை சிறந்து விளங்குவதே நோக்கமாகும்.

அலகு - 1 நெசவு மற்றும் பாணைத் தொழில்நுட்பம் 3
சங்க காலத்தில் நெசவுத் தொழில் - பாணைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் - பாண்டங்களில் கீறில் குறியீடுகள்.

அலகு - 2 வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம் 3
சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு - சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் - சிலப்பதிகாரத்தில் மேடை வடிவமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரச் சிற்பங்களும், கோவில்களும் - சோழர்காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் - நாயக்கர் காலக் கோவில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டிநாட்டு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ-சாரோசெனிக் கட்டிடக் கலை.

அலகு - 3 உற்பத்தித் தொழில்நுட்பம் 3
கப்பல் கட்டும் கலை - உலோகவியல் - இரும்புத் தொழிற்சாலை - இரும்பை உருக்குதல், எஃகு - வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் - நாணயங்கள் அச்சடித்தல் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணாடி மணிகள் - சுடுமண் மணிகள் - சங்கு மணிகள் - எலும்புத்துண்டுகள் - தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

அலகு - 4 வேளாண்மை மற்றும் நீர்பாசனத் தொழில்நுட்பம் 3
அணை, - ஏரி, குளங்கள், மதகு - சோழர்காலக் குமிழித் தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் - வேளாண்மை மற்றும் வேளாண்மை சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு - மீன்வளம் - முத்து மற்றும் முத்துக்குளித்தல் - பொருங்கடல் குறித்த பண்டைய அறிவு - அறிவு சார் சமூகம்.

அலகு - 5 அறிவியல் தமிழ் மற்றும் கணித்தமிழ் 3
அறிவியல் தமிழின் வளர்ச்சி - கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் - தமிழ் மென்பொருட்கள் உருவாக்கம் - தமிழ் இணையக் கல்விக்கழகம் - தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத் திட்டம்.

TOTAL: 15 PERIODS

TEXT BOOKS:

- 1 முனைவர் ஆ. பூபாலன் "தமிழரும் தொழில்நுட்பமும்" வி.ஆர்.பி. வெளியீடு புதிய பாடத்திட்டம் 2023 - 2024 அண்ணா பல்கலைக்கழகம்.
- 2 முனைவர் ஆ. வேறமமாலினி "தமிழரும் தொழில்நுட்பமும்" வி.ஆர்.பி. வெளியீடு புதிய பாடத்திட்டம் 2023 - 2024 அண்ணா பல்கலைக்கழகம்.

REFERENCES:

- 1 முனைவர் கே. கே. பிள்ளை "தமிழக வரலாறு, மக்களும், பண்பாடும்," வெளியீடு:

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- தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம், 1972.
- 2 முனைவர் இல. சுந்தரம், “பொருதை, ஆற்றங்கரை நாகரிகம்,” வெளியீடு: தொல்லியல் துறை மற்றும் தமிழ்நாடு அரசுத் துறை, 2022.
- 3 Dr. S. V. சுப்பிரமணியன், னுச.மு.னு. திருநாவுக்கரசு “தமிழர்களின் வரலாற்று பாரம்பரியம்”, சர்வதேச தமிழ் ஆய்வு நிறுவனம், 2022.

ONLINE RESOURCES:

- 1 <https://youtu.be/7qTXrUs02fs?si=SBBluhJu1i14o6yw>
- 2 <https://youtu.be/A0mxzo4f-s4?si=1C92FLv93BliZ2pn>
- 3 https://youtu.be/Qia72HEV_uE?si=dp06r09Gi1SsKEyQ

COURSE OUTCOMES:

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

- CO1** தமிழின் தொன்மையான வரலாறு மற்றும் தொழில் நுட்பத்தை தொகுக்க இயலும்.
Summarize the ancient history and technology of Tamil.
- CO2** சங்க கால வாழ்க்கை முறை மற்றும் கட்டிடக்கலை நுட்பங்களைப் பற்றி விளக்க இயலும்.
Explain the lifestyle and architectural techniques of the sangam period.
- CO3** பண்டைய தமிழ் மக்களின் வணிக நடை முறைகள் மற்றும் நாணய பரிமாற்றம் பற்றி விளக்க இயலும்.
Explain the business practices and currency exchange of ancient Tamil people.
- CO4** சங்க காலத்தில் வேளாண்மை மற்றும் நீர்பாசனத் தொழில்நுட்ப முறைகளைப் பற்றி தொகுக்க இயலும்.
Summarize the Agriculture and Irrigation Technology in sangam period.
- CO5** கணினி பயன்பாடுகளில், தமிழின் தொழில்நுட்ப வளர்ச்சியினைப் பற்றி விளக்க இயலும்.
Explain the computer applications in Tamil technological development.

CO - PO - PSO MAPPING:

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

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U23EP101

ENGINEERING PRACTICES LABORATORY
(Common to all branches)

L T P C
0 0 3 1.5

Prerequisites: Nil

COURSE OBJECTIVES:

- Drawing pipeline plan; laying and connecting various pipe fittings used in common household plumbing work; Sawing; planning; making joints in wood materials used in common household woodwork.
- Welding various joints in steel plates using arc welding work; Machining various simple processes like turning, drilling, tapping In parts; Assembling simple mechanical assembly of common household equipment's; Making a tray out of metal sheet using sheet metal work.
- Wiring various electrical joints in common household electrical wire work. Soldering and testing simple electronic circuits; Assembling and testing simple electronic components on PCB.

GROUP - A (CIVIL & MECHANICAL)

PART I CIVIL ENGINEERING PRACTICES

I. PLUMBING WORK:

1. Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.
2. Preparing plumbing line sketches.
3. Laying pipe connection to the delivery side of a pump.
4. Connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.

II. WOOD WORK:

1. Sawing,
2. Planing
3. Making joints like T-Joint Mortise joint, Tenon joint, and Dovetail joint.
4. Studying joints in door panels and wooden furniture.
5. Studying common industrial trusses using models.

PART II MECHANICAL ENGINEERING PRACTICES

I. WELDING WORK:

- a) Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding.
- b) Practicing gas welding.

II. BASIC MACHINING WORK:

- a) (Simple) Turning.
- b) (Simple) Drilling.
- c) (Simple) Tapping.

III. ASSEMBLY WORK:

- a) Assembling a centrifugal pump.
- b) Assembling a household mixer.
- c) Assembling an air conditioner.

IV. SHEET METAL WORK:

- a) Making of a square tray.

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U23CS202

DATA STRUCTURES LABORATORY

L T P C
0 0 3 1.5

Prerequisites: C Programming

COURSE OBJECTIVES:

- To apply Stack, Queue and List ADT's operations for solving a given problem.
- To solve various operations like traversal, insertion, deletion on tree and graph data structure.
- To analyze various kinds of searching and sorting techniques.

LIST OF EXPERIMENTS

- 1 Implementation of Stack, Queue ADT using array.
- 2 Implementation of Singly linked list.
- 3 Linked list implementation of Stack and Linear Queue ADTs.
- 4 Implementation of Polynomial Manipulation using Linked list.
- 5 Implementation of Evaluating Postfix Expressions, Infix to Postfix conversion.
- 6 Implementation of Binary Search Trees.
- 7 Implementation of Heaps.
- 8 Tree representation and traversal algorithms.
- 9 Graph representation and traversal algorithms.
- 10 Implementation of Searching Algorithms.
- 11 Implementation of Selection and Insertion Sort.
- 12 Implementation of Merge and Bubble Sort.
- 13 Implementation of Hash tables.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO1** Apply Stack, Queue and List ADT's operations for solving a given problem
- CO2** Solve various operations like traversal, insertion, deletion on tree data structure.
- CO3** Solve various applications using graph algorithms.
- CO4** Analyze various kinds of searching and sorting techniques
- CO5** Apply appropriate hashing techniques for the given problem

CO - PO - PSO MAPPING:

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

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V. FOUNDRY WORK:

- a) Demonstrating basic foundry operations.

GROUP B (ELECTRICAL AND ELECTRONICS)

PART III ELECTRICAL ENGINEERING PRACTICES

- a) Introduction to switches, fuses, indicators and lamps - Basic switch board wiring with lamp, fan and three pin socket.
- b) Staircase wiring.
- c) Fluorescent Lamp wiring with introduction to CFL and LED types.
- d) Energy meter wiring and related calculations/ calibration.
- e) Study of Iron Box wiring and assembly.
- f) Study of Fan Regulator (Resistor type and Electronic type using Diac/ Triac/ quadrac).
- g) Study of emergency lamp wiring/Water heater.

PART IV ELECTRONICS ENGINEERING PRACTICES

I. SOLDERING WORK:

- a) Soldering simple electronic circuits and checking continuity.

ELECTRONIC ASSEMBLY AND TESTING WORK:

- a) Assembling and testing electronic components on a small PCB.

II. ELECTRONIC EQUIPMENT STUDY:

- a) Study an element of smart phone.
- b) Assembly and dismantle of LED TV.
- c) Assembly and dismantle of computer/ laptop.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO1** Apply the basic concept of Plumbing and carpentry in various Residential buildings.
CO2 Apply the concept of arc welding in welding of steel plate.
CO3 Analyze the basics of machining operations and sheet metal works.
CO4 Apply the various electrical joints in common household electrical wire work.
CO5 Apply the basic concept of assemble and testing of simple electronic components on PCB.

CO - PO - PSO MAPPING:

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

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U23MA302

DISCRETE MATHEMATICS

L T P C
3 1 0 4

Pre requisites: Nil

COURSE OBJECTIVES:

- To extend student's logical and mathematical maturity and ability to deal with abstraction.
- To familiarize the applications of combinatorics, graph theory and algebraic structures.
- To understand the concepts and significance of lattices and Boolean algebra which are widely used in computer science and engineering.

UNIT I LOGIC AND PROOFS 12

Propositional logic – Propositional equivalences - Predicates and quantifiers – Rules of inference - Introduction to proofs – Proof methods and strategy.

UNIT II COMBINATORICS 12

Mathematical induction – Strong induction and well ordering – The pigeonhole principle – Permutations and combinations – Recurrence relations – Solving linear recurrence relations – Generating functions – Inclusion and exclusion principle and its applications

UNIT III GRAPHS 12

Graphs and graph models – Graph terminology and special types of graphs – Matrix representation of graphs and graph isomorphism – Connectivity – Euler and Hamilton paths.

UNIT IV ALGEBRAIC STRUCTURES 12

Algebraic systems – Semi groups and monoids - Groups – Subgroups – Homomorphism's – Normal subgroup and cosets – Lagrange's theorem.

UNIT V LATTICES AND BOOLEAN ALGEBRA 12

Partial ordering – Posets – Lattices as posets – Properties of lattices - Lattices as algebraic systems – Sub lattices – Direct product and homomorphism – Some special lattices – Boolean algebra.

TOTAL: 60 PERIODS

TEXT BOOKS:

- 1 C V Sastry, Rakesh Nayak, "A Textbook on Discrete Mathematics", John Wiley & Sons, 2020.
- 2 Kenneth H Rosen, "Discrete Mathematics and its Applications to", 8th Edition, Tata McGraw Hill, 2021.

REFERENCES:

- 1 R P Grimaldi, "Discrete and Combinatorial Mathematics: An Applied Introduction", 4th Edition, Pearson Education, 2019.

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- 2 S Lipschutz, Mark Lipson, "Schaum's Outline of Discrete Mathematics", 4th Edition, Tata McGraw Hill, 2021.
- 3 S Susanna, "Discrete Mathematics with Applications", 5th Edition, Cengage Learning India Private Limited, 2021.

ONLINE RESOURCES:

- 1 <https://nptel.ac.in/courses/111104026>
- 2 <https://www.classcentral.com/course/udemy-master-discrete-mathematics-38403>
- 3 <https://www.coursera.org/learn/discrete-mathematics>

COURSE OUTCOMES:

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

- C01 Apply the concepts of logic theory to construct the truth table, mathematical arguments and different methods of proofs.
- C02 Apply the concepts of mathematical induction, pigeonhole principle, permutation and combination to solve the real life problems.
- C03 Analyze the definitions and different types of graphs.
- C04 Analyze the concepts and properties of algebraic structures.
- C05 Analyze the algebraic properties of lattices and Boolean algebra.

CO - PO - PSO MAPPING:

| | P01 | P02 | P03 | P04 | P05 | P06 | P07 | P08 | P09 | P010 | P011 | P012 | PS01 | PS02 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| C01 | 3 | 2 | 1 | 2 | - | - | - | - | - | - | - | - | 1 | - |
| C02 | 3 | 2 | 1 | 2 | - | - | - | - | - | - | - | - | 1 | - |
| C03 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | - | - | 1 | - |
| C04 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | - | - | 1 | - |
| C05 | 3 | 3 | 2 | 2 | - | - | - | 1 | - | - | - | 1 | 1 | - |

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- 4 Implementation of code converters.
- 5 Implementation of BCD adder, encoder and decoder circuits
- 6 Implementation of functions using Multiplexers.
- 7 Implementation of the synchronous counters and shift register.

30 PERIODS
TOTAL: 75 PERIODS

TEXT BOOKS:

- 1 M Morris Mano, Michael D Ciletti, "Digital Design: With an Introduction to the Verilog HDL, VHDL and System Verilog", 6th Edition, Pearson Education, 2020.
- 2 David A Patterson, John L Hennessy, "Computer Organization and Design, The Hardware/Software Interface", 6th Edition, Morgan Kaufmann, 2020.

REFERENCES:

- 1 Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, "Computer Organization and Embedded Systems", 6th Edition, Tata McGraw Hill, 2022.
- 2 William Stallings, "Computer Organization and Architecture - Designing for Performance", 11th Edition, Pearson Education, 2022.
- 3 M Morris Mano, "Digital Logic and Computer Design", 6th Edition, Pearson Education, 2018.

ONLINE RESOURCES

- 1 <https://archive.nptel.ac.in/courses/117/105/117105078>
- 2 <https://www.coursera.org/courses?query=computer%20architecture>
- 3 https://onlinecourses.nptel.ac.in/noc21_ee39/preview

COURSE OUTCOMES:

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

- CO1 Apply Boolean Algebra and Simplification procedures relevant to digital logic.
- CO2 Design various combinational digital circuits using logic gates.
- CO3 Design synchronous and asynchronous sequential digital circuits using logic gates.
- CO4 Summarize the basic structure and operation of a digital computer.
- CO5 Analyze the data path unit of processor and concept of various memories.

CO - PO - PSO MAPPING:

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

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U23CS301

FOUNDATION OF DATA SCIENCE

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To understand the data science fundamentals and process.
- To utilize the Python libraries for Data Wrangling and interpret data using visualization libraries in Python.
- To describe the data for the data science process and the relationship between data.

UNIT I INTRODUCTION 9

Data Science: facets of data – Data Science Process: Overview – Defining research goals – Retrieving data – Data preparation – Exploratory Data analysis – build the model-presenting findings and building applications – Data Mining – Data Warehousing.

UNIT II PYTHON LIBRARIES FOR DATA WRANGLING 9

Basics of Numpy arrays –aggregations –computations on arrays –comparisons, masks, Boolean logic – fancy indexing – structured arrays – Data manipulation with Pandas – data indexing and selection – operating on data – missing data – Hierarchical indexing – combining datasets – aggregation and grouping – pivot tables.

UNIT III DATA VISUALIZATION 9

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

UNIT IV DESCRIPTIVE STATISTICS 9

Types of Data – Types of Variables - Basic Statistical descriptions of Data-Describing Data with Tables and Graphs –Describing Data with Averages – Describing Variability – Normal Distributions and Standard (z) Scores.

UNIT V DESCRIBING RELATIONSHIPS 9

Correlation –Scatter plots –correlation coefficient for quantitative data –computational formula for correlation coefficient – Regression –regression line –least squares regression line – Standard error of estimate – interpretation of r^2 –multiple regression equations –regression towards the mean.

TOTAL: 45 PERIODS

TEXT BOOKS:

- 1 Jake VanderPlas, "Python Data Science Handbook", O'Reilly, Second Edition, 2022.

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2 Hands-On Exploratory Data Analysis with Python Paperback – Import, 30 March 2020.

REFERENCES:

- 1 Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", Green Tea Press, latest edition 2020.
- 2 David Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing Data Science", Manning Publications, 2016.
- 3 Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", Green Tea Press, 2014.

ONLINE RESOURCES:

- 1 <http://www.digimat.in/nptel/courses/video/106105186/L01.html>.
- 2 https://onlinecourses.swayam2.ac.in/imb24_mg31/preview
- 3 https://onlinecourses.nptel.ac.in/noc24_es54/preview

COURSE OUTCOMES:

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

CO1 Summarize the Data Science Process.

CO2 Explain the Python Libraries for Data Wrangling.

CO3 Describe Visualization Libraries in Python to interpret and explore data.

CO4 Explain the different types of data description for data science process.

CO5 Explain the relationships between data.

CO - PO - PSO MAPPING:

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

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|-----------------|------------------------------------|----------|----------|----------|----------|
| U23CS302 | DATABASE MANAGEMENT SYSTEMS | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

Prerequisites: Data Structures

COURSE OBJECTIVES:

- To learn the fundamentals of data models, relational algebra and SQL
- To represent a database system using ER diagrams and to learn normalization techniques.
- To understand the fundamental concepts of transaction, concurrency and recovery processing, internal storage structures using different file and indexing techniques and Advanced Data bases.

UNIT I RELATIONAL DATABASES 9

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

UNIT II DATABASE DESIGN 9

Entity-Relationship model – E-R Diagrams – Enhanced-ER Model – ER-to-Relational Mapping – Functional Dependencies – Non-loss Decomposition – First, Second, Third Normal Forms, Dependency Preservation – Boyce/Codd Normal Form.

UNIT III TRANSACTIONS 9

Transaction Concepts – ACID Properties – Schedules – Serializability – Transaction support in SQL – Need for Concurrency – Concurrency control – Two Phase Locking- Timestamp – Multi version – Validation and Snapshot isolation- Deadlock Handling – Recovery Concepts – Recovery based on deferred and immediate update.

UNIT IV IMPLEMENTATION TECHNIQUES 9

RAID – File Organization – Organization of Records in Files – Data dictionary Storage – Column Oriented Storage- Indexing and Hashing – Ordered Indices – B+ tree Index Files – B tree Index Files – Static Hashing – Dynamic Hashing – Query Processing Overview – Algorithms for Selection, Sorting and join operations.

UNIT V ADVANCED TOPICS 9

Distributed Databases: Architecture, Data Storage, Transaction Processing, Query processing and optimization – NOSQL Databases: Introduction – CAP Theorem – Document Based systems – Key value Stores – Column Based Systems – Graph Databases.

TOTAL: 45 PERIODS

TEXT BOOKS:

- 1 Abraham Silberschatz, Henry F Korth, S Sudharshan, "Database System Concepts", 8th Edition, Tata McGraw Hill, 2021.

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- Ramez Elmasri, Shamkant B Navathe, "Fundamentals of Database Systems", 7th Edition, Pearson Education, 2018.

REFERENCES:

- Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", 4th Edition, Tata McGraw Hill, 2021.
- Jeffrey A Hoffer, Ramesh Venkataraman, Heikki Topi, "Modern Database Management", 14th Edition, Pearson Education, 2022.
- Hector Garcia-Molina, Jeffrey D Ullman, Jennifer Widom, "Database Systems: The Complete Book", 3rd Edition, Pearson Education, 2021.

ONLINE RESOURCES:

- <https://archive.nptel.ac.in/courses/106/105/106105175/>
- <https://www.coursera.org/articles/relational-database>
- <https://archive.nptel.ac.in/courses/106105174/>

COURSE OUTCOMES:

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

- CO1** Write SQL Queries using SQL commands and Relational Algebra.
- CO2** Design Database using E-R Model and Normalize the database.
- CO3** Summarize transaction Concepts, Concurrency and Recovery Techniques.
- CO4** Describe Internal Storage Structures using files, Indexing, Hashing and Query Optimization.
- CO5** Comprehend Advanced Data bases and Database Security.

CO - PO - PSO MAPPING:

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

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U23CS303

OBJECT ORIENTED PROGRAMMING

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3 0 2 4

Prerequisites: Programming in C

COURSE OBJECTIVES:

- To understand the Object Oriented Programming concepts using Java
- To develop Java application with threads, generic classes, exceptions and use I/O streams.
- To design and build Graphical User Interface Application using JAVAFX.

UNIT I INTRODUCTION TO OOP AND JAVA 9

Overview of OOP – Object oriented programming paradigms – Features of Object Oriented Programming – Java Buzzwords – Overview of Java – Data Types, Variables and Arrays – Operators – Control Statements – Programming Structures in Java – Defining classes in Java – Constructors-Methods -Access specifiers - Static members- Java Doc comments

UNIT II INHERITANCE, PACKAGES AND INTERFACES 9

Overloading Methods – Objects as Parameters – Returning Objects –Static, Nested and Inner Classes. Inheritance: Basics– Types of Inheritance -Super keyword -Method Overriding – Dynamic Method Dispatch –Abstract Classes – final with Inheritance. Packages and Interfaces:Packages – Packages and Member Access –Importing Packages – Interfaces.

UNIT III EXCEPTION HANDLING AND MULTITHREADING 9

Exception Handling basics – Multiple catch Clauses – Nested try Statements – Java’s Built-in Exceptions – User defined Exception. Multithreaded Programming: Java Thread Model– Creating a Thread and Multiple Threads – Priorities – Synchronization – Inter Thread Communication Suspending –Resuming, and Stopping Threads –Multithreading. Wrappers – Auto boxing.

UNIT IV I/O, GENERICS, STRING HANDLING 9

I/O Basics – Reading and Writing Console I/O – Reading and Writing Files. Generics: GenericProgramming – Generic classes – Generic Methods – Bounded Types – Restrictions and Limitations. Strings: Basic String class, methods and String Buffer Class.

UNIT V JAVAFX EVENT HANDLING, CONTROLS AND COMPONENTS 9

JAVAFX Events and Controls: Event Basics – Handling Key and Mouse Events. Controls: Checkbox, ToggleButton – RadioButtons – ListView – ComboBox – ChoiceBox – Text Controls –ScrollPane. Layouts – FlowPane – HBox and VBox – BorderPane – StackPane – GridPane. Menus – Basics – Menu – Menu bars – MenuItem.

45 PERIODS

PRACTICAL EXERCISES:

- 1 Solve problems by using sequential search and binary search.
- 2 Develop stack and queue data structures using classes and objects.
- 3 Solve the above problem using an interface.

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- 4 Implement exception handling and creation of user defined exceptions.
- 5 Write a program to perform file operations.
- 6 Develop applications to demonstrate the features of generics classes.
- 7 Develop applications using JavaFX controls, layouts and menus.

30 PERIODS

TOTAL: 75 PERIODS

TEXT BOOKS:

- 1 Herbert Schildt, "Java: The Complete Reference", 11th Edition, Tata McGraw Hill, 2019.
- 2 Herbert Schildt, "Introducing JavaFX 8 Programming", 1st Edition, Tata McGraw Hill, 2018.

REFERENCES:

- 1 Cay S Horstmann, "Core Java Fundamentals", Volume 1, 11th Edition, Prentice Hall, 2018.
- 2 Y Daniel Liang, "Introduction To Java Programming, Comprehensive", 10th Edition, Pearson Education, 2018.
- 3 Walter Savitch, "Java An Introduction To Problem Solving And Programming", Pearson Education, 2019.

ONLINE RESOURCES:

- 1 https://onlinecourses.nptel.ac.in/noc22_cs47
- 2 <https://www.w3schools.com>
- 3 <https://jenkov.com/tutorials/javafx>

COURSE OUTCOMES:

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

- CO1** Comprehend OOPS concept and basic concepts of JAVA.
- CO2** Apply the principles of inheritance, packages and interfaces
- CO3** Apply features of exception handling and multithreading in Java program.
- CO4** Develop Java applications with I/O, Generic and string handling.
- CO5** Design Java application using JAVA FX Event handling.

CO - PO - PSO MAPPING:

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

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U23MX01

PERSONAL VALUES

L T P C

Prerequisites: Nil

2 0 0 0

COURSE OBJECTIVES:

- To understand the values through practical activities.
- To understand about physical and mental well-being.
- To know about meditation methods.

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, and Responsibility – Measuring personal values.

UNIT III

MORAL VALUES

6

Understanding self-Concept – Identify Yourself – Who am I – an individual, engineer, and citizen – Attitude – Measuring Behaviour – Change of Behaviour – Personality – Characteristics in personal, professional life. Personal Values – Attributes – Courage – Creativity, Honesty, Perfection, Simplicity, Responsibility – Measuring personal values
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 Goal Setting – Decision making skill – Overcome of Barriers – Success – Mental strength and weakness.

UNIT V

DECISION MAKING

6

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

TOTAL: 30 PERIODS

REFERENCES:

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

COURSE OUTCOMES:

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

CO1 Become an individual in knowing the self.

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- C02 Acquire and express Personal Values, Spiritual values and fitness.
 C03 Practice simple physical exercise and breathing techniques.
 C04 Practice Yoga asana which will enhance the quality of life.
 C05 Practice Meditation and get benefitted.

CO - PO - PSO MAPPING:

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

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COURSE OBJECTIVES:

- To develop data analytic code in python
- To be able to use python libraries for handling data.
- To develop analytical applications using python and perform data visualization using plots.

LIST OF EXPERIMENTS

- Working with Numpy arrays: Perform array operations, aggregations, Boolean logic, and broadcasting.
- Practice indexing, slicing, filtering, and reshaping data with Pandas.
- Aggregate data using groupby, merge/join datasets, and work with hierarchical indexes.
- Reading data from text files, Excel and the web and exploring various commands for doing descriptive analytics on the Iris data set.
- Basic plots and Three dimensional plotting using Matplotlib.
- Visualizing Geographic Data with Basemap using Matplotlib.
- Describe data using tables, bar charts, histograms, pie charts, and compute mean, median, mode, variance, and standard deviation.
- Calculate z-scores and visualize normal distribution.
- Compute correlation coefficients and visualize relationships using scatter plots.
- Perform simple linear regression, plot the regression line, and interpret R^2 .

TOTAL: 45 PERIODS**COURSE OUTCOMES:**

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

- CO1 Summarize the python libraries for data science.
 CO2 Design a descriptive analysis on the benchmark dataset.
 CO3 Design data using visualization packages in python.
 CO4 Design Correlation and Regression Analytics on standard data set.
 CO5 Design the basic statistical and probability measures for data Science.

CO - PO - PSO MAPPING:

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

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U23CS305 DATABASE MANAGEMENT SYSTEMS LABORATORY**L T P C****Prerequisites: Programming in C****0 0 3 1.5****COURSE OBJECTIVES:**

- To study the principles to be followed to create an effective relational database and write SQL queries to store/retrieve data to/from database systems.
- To know the fundamental concepts of transaction processing, concurrency control techniques and recovery procedure.
- To learn how to use database management systems.

PRACTICAL EXERCISES

- 1 Implementation of DDL commands of SQL with suitable examples
- 2 Implementation of DML commands of SQL with suitable examples
- 3 Implementation of different types of where clause conditions and also implement aggregate functions in SQL.
- 4 Implementation of different types of operators in SQL
- 5 Implementation of different types of Joins
- 6 Study and implementation of sub queries in SQL.
- 7 Study and implementation of pattern matching in SQL.
- 8 Study and implementation of different types of constraints.
- 9 Write user defined functions in SQL.
- 10 Write stored procedures in SQL
- 11 Execute complex transactions and realize DCL and TCL commands. Write SQL Triggers for insert, delete, and update operations in database table.
- 12 Write SQL Triggers for insert, delete, and update operations in database table.

TOTAL: 45 PERIODS**COURSE OUTCOMES:****Upon the completion of the course, the students will be able to**

- CO1** Create databases with different types of key constraints.
- CO2** Analyze simple and complex SQL queries using DML and DCL commands.
- CO3** Apply advanced features such as stored procedures and triggers incorporate in GUI based application development
- CO4** Create an XML database and validate with meta-data(XML schema)
- CO5** Create and manipulate data using NOSQL database

CO – PO – PSO MAPPING:

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

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U23CS401

MACHINE LEARNING TECHNIQUES

L T P C
3 0 2 4

Prerequisites : Problem Solving and Python Programming

COURSE OBJECTIVES:

- To explore uninformed and heuristic search techniques.
- To acquire knowledge in reasoning under uncertainty.
- To introduce supervised learning algorithms and delve into Machine Learning.

UNIT I

PROBLEM SOLVING

9

Introduction to AI - AI Applications - Problem solving agents – search algorithms uninformed search strategies – Heuristic search strategies – Local search and optimization problems – adversarial search– constraint satisfaction problems (CSP).

UNIT II

PROBABILISTIC REASONING

9

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

UNIT III

SUPERVISED LEARNING

9

Introduction to machine learning – Linear Regression Models: Least squares, single & multiple variables, Linear Classification Models: Discriminant function -Probabilistic discriminative model - Logistic regression, Probabilistic generative model – Naive Bayes, Maximum margin classifier, Decision Trees: ID3, Classification and Regression Trees (CART), Support vector machines.

UNIT IV

ENSEMBLE TECHNIQUES AND UNSUPERVISED LEARNING

9

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

UNIT V

ARTIFICIAL NEURAL NETWORKS


9

Neural Network Representation – Problems – Perceptrons, Activation Functions, Artificial Neural Networks (ANN) , Back Propagation Algorithm -Convolutional Neural Networks - Convolution and Pooling layers, Recurrent Neural Networks (RNN).

45 PERIODS

PRACTICAL EXERCISES:

- 1 Implementation of Uninformed search algorithms (BFS, DFS).
- 2 Implementation of Informed search algorithms (A*, memory-bounded A*).
- 3 Implement naïve Bayes models.
- 4 Implement Bayesian Networks.
- 5 Build Regression models.

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- 6 Build decision trees and random forests.
- 7 Build simple NN models.

30 PERIODS
TOTAL: 75 PERIODS

TEXT BOOKS:

- 1 Stuart Russell, Peter Norvig, "Artificial Intelligence – A Modern Approach", 4th Edition, Pearson Education, 2021.
- 2 Ethem Alpaydin, "Introduction to Machine Learning", 4th Edition, MIT Press, 2020.

REFERENCES:

- 1 Dan W Patterson, "Introduction to Artificial Intelligence and Expert Systems", Pearson Education, 2020.
- 2 Kevin Night, Elaine Rich, Nair B, "Artificial Intelligence", 3rd Edition, Tata McGraw Hill, 2019.
- 3 Kevin P Murphy, "Probabilistic Machine Learning: An Introduction", MIT Press, 2022.

ONLINE RESOURCES

- 1 <https://towardsdatascience.com/machine-learning-probability-statistics-f830f8c09326>
- 2 <https://nptel.ac.in/courses/106/105/106105152/>
- 3 <https://nptel.ac.in/courses/117105084>

COURSE OUTCOMES:

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

- CO1** Apply search-based problem-solving methods for AI applications.
- CO2** Apply the Bayesian concepts to machine learning problems.
- CO3** Apply the concept of Supervised learning models.
- CO4** Analyze the strategy for ensembling and unsupervised learning.
- CO5** Summarize the significant features of neural networks.

CO – PO – PSO MAPPING:

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

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U23CS402

DESIGN AND ANALYSIS OF ALGORITHMS

L T P C
3 0 2 4

Prerequisites: Data Structures

COURSE OBJECTIVES:

- To understand and apply the algorithm analysis techniques.
- To understand efficiency and design techniques of different algorithm.
- To understand the basic concepts of NP completeness and approximation algorithm.

UNIT I INTRODUCTION 9

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

UNIT II GRAPH ALGORITHMS 9

Graph algorithms: Representations of graphs – Graph traversal: DFS – BFS - applications – Connectivity, strong connectivity, bi-connectivity – Minimum spanning tree: Kruskal's and Prim's algorithm- Shortest path: Bellman-Ford algorithm – Dijkstra's algorithm – Floyd-Warshall algorithm Network flow: Flow networks - Ford-Fulkerson method – Matching: Maximum bipartite matching.

UNIT III ALGORITHM DESIGN TECHNIQUES 9

Divide and Conquer methodology: Finding maximum and minimum – Merge sort – Quick sort Dynamic programming: Elements of dynamic programming – Matrix-chain multiplication – Multi stage graph – Optimal Binary Search Trees, Greedy Technique: Elements of the greedy strategy – Activity – selection problem – Optimal Merge pattern – Huffman Trees.

UNIT IV STATE SPACE SEARCH ALGORITHMS 9

Backtracking: n-Queens problem - Hamiltonian Circuit Problem – Subset Sum Problem – Graph colouring problem Branch and Bound: Solving 15-Puzzle problem – Assignment problem – Knapsack Problem – Travelling Salesman Problem.

UNIT V NP-COMPLETE AND APPROXIMATION ALGORITHM 9

Lower – Bound Arguments – P, NP NP – Complete and NP Hard Problems, Approximation Algorithms for NP-Hard Problems – Travelling Salesman problem – Knapsack problem.

45 PERIODS

PRACTICAL EXERCISES:

- 1 Implement Linear Search. Determine the time required to search for an element.
- 2 Repeat the experiment for different values of n, the number of elements in the list to be searched and plot a graph of the time taken versus n.
- 3 Implement recursive Binary Search. Determine the time required to search an element.
- 4 Repeat the experiment for different values of n, the number of elements in the list to be searched and plot a graph of the time taken versus n.
- 5 Given a text txt [0...n-1] and a pattern pat [0...m-1], write a function search (char pat [], char

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txt [] that prints all occurrences of pat [] in txt []. You may assume that $n > m$.

- 6 Develop a program to implement graph traversal using Breadth First Search.
- 7 Develop a program to implement graph traversal using Depth First Search.

30 PERIODS
TOTAL: 75 PERIODS

TEXT BOOKS:

- 1 S Sridhar, "Design and Analysis of Algorithms", 2nd Edition, Oxford University Press, 2023.
- 2 Thomas H Cormen, Charles E Leiserson, Ronald L Rivest and Clifford Stein, "Introduction to Algorithms", 4th Edition, MIT Press, 2022.

REFERENCES:

- 1 Anany Levitin, "Introduction to the Design and Analysis of Algorithms", 3rd Edition, Pearson Education, 2018.
- 2 Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, "Fundamentals of computer Algorithms", 2nd Edition, Universities Press, 2018.
- 3 Ethem Alpaydin, "Introduction to Algorithms", 4th Edition, MIT Press, 2020.

ONLINE RESOURCES

- 1 <http://nptel.ac.in/courses/106106131>
- 2 <http://nptel.ac.in/courses/106101059>
- 3 <https://www.coursera.org/learn/advanced-algorithms-and-complexity>

COURSE OUTCOMES:

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

- CO1** Analyze search, sort and string matching algorithms to compute their efficiency.
- CO2** Apply graph algorithms to solve problems and analyze their efficiency.
- CO3** Apply algorithm design techniques like divide & conquer, dynamic programming and greedy techniques to solve problems.
- CO4** Apply the state space tree method for solving problems.
- CO5** Solve problems using approximation algorithms and NP-Complete.

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 | 2 | - | - | 2 | 2 |
| CO2 | 3 | 2 | 1 | 2 | 1 | - | - | 1 | 1 | 2 | - | - | 2 | 2 |
| CO3 | 3 | 2 | 1 | 2 | 1 | - | - | 1 | 1 | 2 | - | - | 2 | 2 |
| CO4 | 3 | 2 | 1 | 2 | 1 | - | - | 1 | 1 | 2 | - | - | 2 | 2 |
| CO5 | 3 | 2 | 1 | 2 | 1 | - | - | 1 | 1 | 2 | - | - | 2 | 2 |

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U23CS403

THEORY OF COMPUTATION

L T P C

Prerequisites: Data Structures

3 0 0 3

COURSE OBJECTIVES:

- To understand foundations of computation including automata theory with regular expressions and languages.
- To design context free grammar and push down automata.
- To design Normal Forms and Turing machines.

UNIT I AUTOMATA AND REGULAR EXPRESSIONS 9

Need for automata theory - Introduction to formal proof - Finite Automata (FA) Deterministic Finite Automata (DFA) - Non-deterministic Finite Automata (NFA) Equivalence between NFA and DFA-Finite Automata with Epsilon transitions - Equivalence of NFA and DFA- Equivalence of NFAs with and without ϵ -moves- Conversion of NFA into DFA - Minimization of DFAs.

UNIT II REGULAR EXPRESSIONS AND LANGUAGES 9

Regular expression - Regular Languages- Equivalence of Finite Automata and regular expressions-Proving languages to be not regular (Pumping Lemma) - Closure properties of regular languages.

UNIT III CONTEXT FREE GRAMMAR AND PUSH DOWN AUTOMATA 9

Types of Grammar - Chomsky's hierarchy of languages -Context-Free Grammar (CFG) and Languages - Derivations and Parse trees - Ambiguity in grammars and languages - Push Down Automata (PDA): Definition - Moves - Instantaneous descriptions -Languages of pushdown automata - Equivalence of pushdown automata and CFG-CFG to PDA-PDA to CFG Deterministic Pushdown Automata.

UNIT IV NORMAL FORMS AND TURING MACHINES 9

Normal forms for CFG - Simplification of CFG- Chomsky Normal Form (CNF) and Greibach Normal Form (GNF) - Pumping lemma for CFL - Closure properties of Context Free Languages -Turing Machine: Basic model - definition and representation - Instantaneous Description - Language acceptance by TM - TM as Computer of Integer functions Programming techniques for Turing machines (subroutines).

UNIT V UNDECIDABILITY 9

Unsolvable Problems and Computable Functions -PCP-MPCP- Recursive and recursively enumerable languages - Properties - Universal Turing machine -Tractable and Intractable problems-P and NP completeness - Kruskal's algorithm - Travelling Salesman Problem- 3-CNF SAT problems.

TOTAL: 45 PERIODS

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TEXT BOOKS:

- 1 Dexter C Kozen, "Theory of Computation", 2nd Edition, Springer, 2020.
- 2 Manish K Sah, Sagar Khandelwal, "Theory of Computation", 6th Edition, Ashirwad, 2019.

REFERENCES:

- 1 J E Motwani R, Ullman J D, "Introduction to Automata Theory, Languages and Computations", 3rd Edition, Pearson Education, 2017.
- 2 K L P Mishra, N Chandrasekaran, "Theory of Computer Science: Automata Languages and Computation", 3rd Edition, Prentice Hall of India, 2018.
- 3 Varsha H Patil, Vaishali S Pawar, "Theory of Computation Simplified: Simulate Real-world Computing Machines and Problems with Strong Principles of Computation", BPB Publications, 2022.

ONLINE RESOURCES:

- 1 <http://www.digimat.in/nptel/courses/video/106104148/L01.html>
- 2 <https://www.classcentral.com/course/youtube-toc-theory-of-computation-46804>
- 3 <https://archive.nptel.ac.in/courses/106/104/106104148/>

COURSE OUTCOMES:

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

- CO1** Describe Automata Theory by using Finite Automata (FA) – Deterministic Finite Automata (DFA) – Non-deterministic Finite Automata.
- CO2** Apply Regular expressions for any pattern.
- CO3** Design context free grammar with Derivations with parse trees and Languages Push Down Automata with equivalence.
- CO4** Design Turing machine for computational functions of CNF, CFG and GNF.
- CO5** Explain Undecidable, Tractable, Intractable problems and Kruskal's algorithms.

CO - PO - PSO MAPPING:

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

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U23CS404 OPERATING SYSTEMS L T P C

Prerequisites: NIL 3 0 0 3

COURSE OBJECTIVES:

- To acquire basic knowledge on computer operating system structures and functioning and Processes, Thread and analyze the scheduling algorithm, Process Synchronization and concept of deadlocks.
- To analyze various memory management, I/O management and File Systems.

- To be familiar with the basics of virtual machines and Mobile OS like IOS and Android.

UNIT I INTRODUCTION TO OPERATING SYSTEM 7
Computer System - Elements and organization; Operating System Overview - Objectives and Functions - Evolution of Operating System; Operating System Structures - Operating System Services - System Calls - System Programs.

UNIT II PROCESS MANAGEMENT 11
Processes - Process Concept - Process Scheduling - Operations on Processes - Inter-process Communication; CPU Scheduling -Scheduling criteria - Scheduling algorithms. The critical-section problem - Mutex- Semaphores - Classic problems of synchronization - Monitors - Deadlock characterization - Methods for handling deadlocks - Deadlock prevention - Deadlock avoidance - Deadlock detection and Recovery .

UNIT III MEMORY MANAGEMENT 10
Main Memory - Swapping - Contiguous Memory Allocation - Paging - Structure of the Page Table - Segmentation, Segmentation with paging; Virtual Memory - Demand Paging - Copy on Write - Page Replacement - Allocation of Frames -Thrashing.

UNIT IV STORAGE MANAGEMENT 10
Mass Storage system - Disk Structure - Disk Scheduling and Management; File-System Interface - File concept - Access methods - Directory Structure - Directory organization - File system mounting - File Sharing and Protection; File System Implementation - File System Structure - Directory implementation - Allocation Methods - Free Space Management; I/O Systems - I/O Hardware, Application I/O interface, Kernel I/O subsystem.

UNIT V VIRTUAL MACHINES AND MOBILE OS 9
Virtual Machines - History, Benefits and Features, Building Blocks, Types of Virtual Machines and their Implementations, Virtualization and Operating-System Components; Mobile OS - IOS and Android.

TOTAL :45 PERIODS

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TEXT BOOKS:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 10th Edition, John Wiley and Sons Inc., 2021
2. William Stallings, "Operating Systems – Internals and Design Principles", 9th Edition, Prentice Hall, 2019

REFERENCES:

1. Achyut S. Godbole, Atul Kahate, "Operating Systems", McGraw Hill Education, 2018.
2. Andrew S. Tanenbaum, "Modern Operating Systems", 5th Edition, Pearson Education, 2022.

ONLINE RESOURCES:

1. <https://archive.nptel.ac.in/courses/106/105/106105214/>
2. https://onlinecourses.nptel.ac.in/noc20_cs04/preview
3. <https://www.youtube.com/watch?v=3Qfx4geYN91>

COURSE OUTCOMES:

- CO1** Comprehend the basic concepts and functions of operating systems..
- CO2** Apply various CPU scheduling algorithms, Synchronization primitives and deadlock, handling methods.
- CO3** Apply the Various memory management schemes and page replacement algorithms.
- CO4** Apply the various disk scheduling algorithms, file system implementation and Security mechanism.
- CO5** Describe the basics of Virtualization and Mobile OS.

CO – PO – PSO MAPPING:

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

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U23CS405

COMPUTER NETWORKS

| L | T | P | C |
|---|---|---|---|
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Prerequisites: Nil

COURSE OBJECTIVES:

- To understand the concept of layering in networks and to know the functions of protocols of each layer.
- 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 APPLICATION LAYER 9

Data Communication – Networks – Network Types – Protocol Layering – TCP/IP Protocol suite –OSI Model – Introduction to Sockets – Application Layer protocols: HTTP – FTP – Email protocols (SMTP – POP3 – IMAP – MIME) – DNS – SNMP.

UNIT II TRANSPORT LAYER 9

Introduction – Transport-Layer Protocols: UDP – TCP: Connection Management – Flow control –Congestion Control – Congestion avoidance (DECbit, RED) – SCTP – Quality of Service.

UNIT III NETWORK LAYER 9

Switching : Packet Switching – Internet protocol – IPV4 – IP Addressing – Subnetting – IPV6, ARP, RARP, ICMP, DHCP.

UNIT IV ROUTING 9

Routing and protocols: Unicast routing – Distance Vector Routing – RIP – Link State Routing– OSPF– Path-vector routing – BGP – Multicast Routing: DVMRP – PIM.

UNIT V DATA LINK AND PHYSICAL LAYERS 9

Data Link Layer – Framing – Flow control – Error control – Data-Link Layer Protocols – HDLC –PPP – Media Access Control – Ethernet Basics – CSMA/CD – Virtual LAN – Wireless LAN (802.11)–Physical Layer: Data and Signals – Performance – Transmission media- Switching – Circuit Switching.

TOTAL: 45 PERIODS

TEXT BOOKS:

- 1 James F Kurose, Keith W Ross, "Computer Networking A Top-Down Approach Featuring the Internet", 8th Edition, Pearson Education, 2021.
- 2 Behrouz A Forouzan, "Data Communications and Networking with TCP/IP Protocol Suite", 6th Edition, Tata McGraw Hill, 2022.

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REFERENCES:

- 1 Larry L Peterson, Bruce S Davie, "Computer Networks A Systems Approach", 5th Edition, Morgan Kaufmann Publishers, 2018.
- 2 William Stallings, "Data and Computer Communications", 10th Edition, Pearson Education, 2019.
- 3 Nader F Mir, "Computer and Communication Networks", 2nd Edition, Prentice Hall, 2018.

ONLINE RESOURCES:

- 1 <https://archive.nptel.ac.in/courses/106/105/106105183>.
- 2 <https://archive.nptel.ac.in/courses/106/105/106105154/>
- 3 <https://archive.nptel.ac.in/courses/106/106/106106168/>

COURSE OUTCOMES:

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

- CO1** Summarize the basic layers and various application layer protocols.
CO2 Comprehend the transport layer protocols, congestion control and avoidance techniques.
CO3 Describe the switching techniques and various protocols on the network layer.
CO4 Analyze various routing algorithms and protocols.
CO5 Comprehend the data flow in data link layer and physical layer.

CO – PO – PSO MAPPING:

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

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U23CS406

SOFTWARE ENGINEERING

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3 0 0 3

Prerequisites : C Programming

COURSE OBJECTIVES:

- To understand the phases in a software project
- To understand fundamental concepts of requirements engineering and Analysis Modeling.
- To learn the various software design methodologies , testing and maintenance measures

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 SPECIFICATION 9

Software Requirements: Functional and Non-Functional, User requirements, System requirements, Software Requirements Document – Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management-Classical analysis: Structured system Analysis, Petri Nets- Data Dictionary.

UNIT III SOFTWARE DESIGN 9

Design process – Design Concepts-Design Model– Design Heuristic – Architectural Design Architectural styles, Architectural Design, Architectural Mapping using Data Flow- User Interface Design: Interface analysis, Interface Design –Component level Design: Designing Class based components, traditional Components.

UNIT IV 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

UNIT V PROJECT MANAGEMENT 9

Software Project Management: Estimation – LOC, FP Based Estimation, Make/Buy Decision COCOMO I & II Model – Project Scheduling – Scheduling, Earned Value Analysis Planning – Project Plan, Planning Process, RFP Risk Management Identification, Projection - Risk Management-Risk Identification-RMMM Plan-Case Tools

TOTAL: 45 PERIODS

TEXT BOOKS:

- 1 Roger S Pressman, "Software Engineering – A Practitioner"s Approach", 7th Edition, Tata McGraw Hill, 2020.
- 2 Ian Sommerville, "Software Engineering", 9th Edition, Pearson Education, 2018.

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REFERENCES:

- 1 Rajib Mall, "Fundamentals of Software Engineering", 3rd Edition, Prentice Hall of India, 2019
- 2 Kelkar S A , "Software Engineering", 1st Edition , Prentice Hall of India, 2017.
- 3 Stephen R Schach, "Software Engineering", 3rd Edition, Tata McGraw Hill, 2019.

ONLINE RESOURCES:

- 1 https://onlinecourses.nptel.ac.in/noc20_cs68/preview
- 2 https://www.aicte-india.org/opportunities/students/resources_students
- 3 <https://archive.nptel.ac.in/courses/106/105/106105182/>

COURSE OUTCOMES:

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

- CO1** Summarize the Software process and Agile Development.
CO2 Describe the Requirement process and their specifications.
CO3 Comprehend systematic procedure for software design.
CO4 Explain systematic procedure for software Testing, Deployment and Maintenance.
CO5 Describe the Project Planning and Management process.

CO – PO – PSO MAPPING:

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

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U23CS407

OPERATING SYSTEMS LABORATORY

L T P C

Prerequisites Programming in C

0 0 3 1.5

COURSE OBJECTIVES:

- To install windows operating systems.
- To understand the basics of Unix command and shell programming.
- To implement various CPU scheduling algorithms.

PRACTICAL EXERCISES

1. Illustrate UNIX commands and Shell Programming.
2. Process Management using System Calls : Fork, Exit, Getpid, Wait, Close.
3. Write C programs to implement the various CPU Scheduling Algorithms.
4. Write C programs to avoid Deadlock using Banker's Algorithm.
5. Write C program to implement Threading.
6. Implement the paging Technique using C program.
7. Write C programs to implement the following Memory Allocation Methods
 - a. First Fit
 - b. Worst Fit
 - c. Best Fit
8. Write C programs to implement the various Page Replacement Algorithms.
9. Implement the following File Allocation Strategies using C programs
 - a. Sequential
 - b. Indexed
 - c. Linked
10. Write C programs for the implementation of various disk scheduling algorithms.

TOTAL :45 PERIODS

COURSE OUTCOMES:

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

- CO1 Design and implement UNIX Commands ,Shell Programming and System calls.
- CO2 Write the Program for various CPU Scheduling and Deadlock using Banker's algorithms.
- CO3 Design the Program for Threading and Paging.
- CO4 Create Program for Memory Allocation Methods and Page Replacement Algorithms.
- CO5 Design the Program for File allocation and various disk Scheduling Algorithms.

CO - PO - PSO MAPPING:

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

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(Signature)

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COURSE OBJECTIVES:

- To understand socket programming.
- To learn various networking protocols.
- To understand various routing algorithms and congestion control algorithms.

LIST OF EXPERIMENTS:

- 1 Learn to use commands like tcpdump, netstat, ifconfig, nslookup and trace route
Capturing and trace route PDUs using a network protocol analyzer and examine.
- 2 Applications using TCP Sockets like a) Echo client and echo server, b) Chat
- 3 Implementation of Stop and Wait Protocol and Sliding Window Protocol.
- 4 Write a HTTP web client program to download a web page using TCP sockets.
- 5 Implementation of Remote Command Execution.
- 6 Simulation of DNS using UDP sockets.
- 7 Implementation of Remote Method Invocation
- 8 Write a code simulating ARP /RARP protocols.
- 9 Implementation of Subnetting.
- 10 Study of Network simulator (NS) and Simulation of Congestion Control Algorithms using NS.
- 11 Simulation of Distance Vector/ Link State Routing algorithm.
- 12 Simulation of an error correction code (like CRC).

TOTAL: 45 PERIODS**COURSE OUTCOMES:**

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

- CO1 Write commands and program for packets capturing and traceroute.
 CO2 Create applications using TCP and UDP Sockets.
 CO3 Write program for simulating ARP/RARP protocols.
 CO4 Write program for Subnetting.
 CO5 Write commands and program for packets capturing and traceroute.

CO - PO - PSO MAPPING:

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

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U23CS501

COMPILER DESIGN

L T P C

Prerequisites: Theory of Computation

3 0 0 3

COURSE OBJECTIVES:

- To learn the various phases of compiler the various parsing techniques.
- To understand intermediate code generation and run-time environment.
- To understand front-end of the Run time Environment with code generation

UNIT I INTRODUCTION TO COMPILERS 9

Structure of a compiler – Lexical Analysis – Role of Lexical Analyzer – Input Buffering – Specification of Tokens – Recognition of Tokens – Lex – Finite Automata – Regular Expressions to Automata – Minimizing DFA.

UNIT II SYNTAX ANALYSIS 12

Role of Parser – Grammars – Error Handling – Context-free grammars – Writing a grammar – Top Down Parsing - General Strategies Recursive Descent Parser Predictive Parser LL(1) Parser-Shift Reduce Parser-LR Parser-LR (0)Item Construction of SLR Parsing Table - Introduction to LALR Parser - Error Handling and Recovery in Syntax Analyzer-YACC.

UNIT III INTERMEDIATE CODE GENERATION 8

Syntax Directed Definitions, Evaluation Orders for Syntax Directed Definitions, Intermediate Languages: Syntax Tree, Three Address Code, Types and Declarations, Translation of Expressions, Type Checking.

UNIT IV RUN-TIME ENVIRONMENT AND CODE GENERATION 8

Storage Organization, Stack Allocation Space, Access to Non-local Data on the Stack, Heap Management - Issues in Code Generation - Design of a simple Code Generator.

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", 2nd Edition, Pearson Education, 2019.
- 2 Randy Allen, Ken Kennedy, "Optimizing Compilers for Modern Architectures: A Dependence based Approach", 1st Edition, Morgan Kaufmann Publishers, 2021.

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REFERENCES:

- 1 Steven S Muchnick, "Advanced Compiler Design and Implementation", 2nd Edition, Morgan Kaufmann Publishers, 2020.
- 2 Keith D Cooper, Linda Torczon, "Engineering a Compiler", 3rd Edition, Morgan Kaufmann Publishers, 2021.
- 3 V Raghavan, "Principles of Compiler Design", 2nd Edition, Tata McGraw Hill, 2020.

ONLINE WEB RESOURCES:

- 1 <https://archive.nptel.ac.in/courses/106/105/106105190/>
- 2 https://onlinecourses.nptel.ac.in/noc21_cs07/preview
- 3 <https://archive.nptel.ac.in/courses/106/104/106104123/>

COURSE OUTCOMES:

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

- CO1** Describe the techniques in Lexical, Syntax, Semantic, Intermediate code generation and Code optimization of a compiler.
- CO2** Design a Lexical analyzer for a sample language and for Error Handling Recovering in Syntax Analyze and YACC.
- CO3** Summarize the Syntax Directed Definitions, Syntax tree, Three Address codes types and declarations.
- CO4** Design a simple Code generator with Storage organization, Stack Allocation, Heap Management and issues in Code generator.
- CO5** Apply the Code Optimization techniques with the basic blocks, DAG and Peep Hole Optimization.

CO - PO - PSO MAPPING:

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

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U23CS502 **CRYPTOGRAPHY AND NETWORK SECURITY** **L T P C**
Prerequisites: Computer Networks, Probability and Queuing Theory. **3 0 0 3**

COURSE 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 the operation of a Message Authentication and Integrity

UNIT I **INTRODUCTION** **9**

Security trends - Legal, Ethical and Professional Aspects of Security, Need for Security at Multiple levels, Security Policies - Model of network security – Security attacks, services and mechanisms – OSI security architecture – Classical encryption techniques: substitution techniques, transposition techniques, steganography- Foundations of modern cryptography: perfect security – information theory – product cryptosystem – cryptanalysis..

UNIT II **SYMMETRIC KEY CRYPTOGRAPHY** **9**

Mathematics of symmetric key cryptography: Algebraic structures - Modular arithmetic- Euclid's algorithm- Congruence and matrices - Groups, Rings, Fields- Finite fields- SYMMETRIC KEY CIPHERS: DES – Block cipher Principles of DES – Strength of DES – Differential and linear cryptanalysis - Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – Advanced Encryption Standard - RC4 – Key distribution

UNIT III **PUBLIC KEY CRYPTOGRAPHY** **9**

Mathematics of asymmetric key cryptography: Primes – Primarily Testing – Factorization – Euler's totient function, Fermat's and Euler's Theorem - Chinese Remainder Theorem – Exponentiation and logarithm - ASYMMETRIC KEY CIPHERS: RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange - ElGamal cryptosystem – Elliptic curve arithmetic-Elliptic curve cryptography.

UNIT IV **MESSAGE AUTHENTICATION AND INTEGRITY** **9**

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – SHA – Digital signature and authentication protocols – DSS- Entity Authentication: Biometrics, Passwords, Challenge Response protocols- Authentication applications - Kerberos, X.509

UNIT V **SECURITY PRACTICE AND SYSTEM SECURITY** **9**

Electronic Mail security – PGP, S/MIME – IP security – Web Security - system security: Intruders – Malicious software – viruses – Firewalls.

TOTAL:45 PERIODS

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TEXT BOOKS:

- 1 William Stallings, "Cryptography and Network Security: Principles and Practice", 3rd Edition, Prentice Hall of India, 2021.
- 2 Behrouz A Foruzan, "Cryptography and Network Security", 4th Edition, Tata McGraw Hill, 2022.

REFERENCES:

- 1 C K Shyamala, N Harini, T R Padmanabhan: "Cryptography and Network Security", 2nd Edition, John Wiley & Sons, 2019.
- 2 Charlie Kaufman, Radia Perlman, Mike Speciner, "Network Security: PRIVATE communication in a PUBLIC World", 2nd Edition, Prentice Hall of India, 2020.

ONLINE WEB RESOURCES:

- 1 <https://archive.nptel.ac.in/courses/106/105/106105162>
- 2 <https://www.ibm.com/docs/en/zos/2.4.0?topic=services-managing-data-integrity-message-authentication>
- 3 <https://www.synopsys.com/blogs/software-security/cryptography-best-practices.html>

COURSE OUTCOMES:

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

- CO1** Summarize the fundamentals of Networks security, Security Architecture, threats and Vulnerabilities
- CO2** Apply the different cryptographic operations of DES, SDES, AES and RC4 symmetric cryptographic algorithms.
- CO3** Apply the different cryptographic operations by using Chinese Remainder Theorem, Euler's totient and Fermat's theorem for RSA and Key distributions in public key cryptography.
- CO4** Apply the various Authentication schemes MAC, HASH, HMAC, CMAC, SHA and Digital Signature to simulate different applications.
- CO5** Describe the various Security practices and Stds of Email, IP, PGP, S/MIME and Firewalls.

CO - PO - PSO MAPPING:

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

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U23CS503

OBJECT ORIENTED ANALYSIS AND DESIGN

L T P C

Prerequisites: Object Oriented Programming

3 0 0 3

COURSE OBJECTIVES:

- To understand the fundamentals of object modelling and differentiate Unified Process from other approaches
- To design with Static, Dynamic and Implementation of UML diagrams.
- To improve the software design with design patterns & to test the software against its requirements specification.

UNIT I UNIFIED PROCESS AND USE CASE DIAGRAMS 9

Introduction to OOAD with OO Basics - Unified Process - UML diagrams - Use Case - Case study - the Next Gen POS system, Inception - Use case Modelling - Relating Use cases - include, extend and generalization - When to use Use-cases.

UNIT II STATIC UML DIAGRAMS 9

Class Diagram - Elaboration - Domain Model - Finding conceptual classes and description classes - Associations - Attributes - Domain model refinement - Finding conceptual class Hierarchies - Aggregation and Composition - Relationship between sequence diagrams and use cases - When to use Class Diagrams.

UNIT III DYNAMIC AND IMPLEMENTATION UML DIAGRAMS 9

Dynamic Diagrams - UML interaction diagrams - System sequence diagram - Collaboration diagram - When to use Communication Diagrams - State machine diagram and Modelling - When to use State Diagrams - Activity diagram - When to use activity diagrams. Implementation Diagrams - UML package diagram - When to use package diagrams - Component and Deployment Diagrams - When to use Component and Deployment diagrams

UNIT IV DESIGN PATTERNS 9

GRASP: Designing objects with responsibilities - Creator - Information expert - Low Coupling - High Cohesion - Controller. Design Patterns - creational - factory method - structural - Bridge - Adapter - behavioural - Strategy - observer - Applying GoF design patterns - Mapping design to code.

UNIT V TESTING 9

Object Oriented Methodologies - Software Quality Assurance - Impact of object orientation on Testing - Develop Test Cases and Test Plans.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Craig Larman, "Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development", 3rd Edition, Pearson Education, 2019.

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- 2 Stephen H Revell, "Object-Oriented Design & Programming", 4th Edition, Pearson Education, 2021.

REFERENCES:

- 1 Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides, "Design patterns: Elements of Reusable Object-Oriented Software", 3rd Edition, Addison-Wesley, 2021.
- 2 Martin Fowler, "UML Distilled: A Brief Guide to the Standard Object Modelling Language", 3rd Edition, Addison Wesley, 2019.

ONLINE WEB RESOURCES:

- 1 <https://archive.nptel.ac.in/courses/106/105/106105153/>
- 2 www.guru99.com/object-oriented-analysis-and-design/
- 3 <https://www.geeksforgeeks.org/object-oriented-analysis-and-design/>

COURSE OUTCOMES:

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

- CO1 Comprehend the Unified Process and Use case diagrams.
- CO2 Describe various Static UML Diagrams.
- CO3 Comprehend the Dynamic and Implementation of UML Diagrams.
- CO4 Describe UML based software design into Pattern based design using Design Patterns.
- CO5 Summarize the various testing methodologies for OO software.

CO - PO - PSO MAPPING:

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

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U23MG501

PROFESSIONAL ETHICS AND IPR

L T P C

Prerequisites: Nil

2 0 0 2

COURSE OBJECTIVES:

- To enable the students to create an awareness on engineering ethics and human values.
- To know how to apply safety, responsibility and rights in workplaces.
- To install moral and social values and loyalty and to appreciate the rights of others.

UNIT I

HUMAN VALUES

6

Morals, Values and Ethics – Integrity – Work Ethics – Service Learning – Civic Virtue – Respect for Others – Living Peacefully – Caring - Sharing – Honesty – Courage – Valuing Time – Cooperation – Commitment – Empathy – Self-Confidence - Character – Spirituality.

UNIT II

ENGINEERING ETHICS

6

Senses of 'Engineering Ethics' – variety of moral issued - types of inquiry – moral dilemmas – moral autonomy – Kohlberg's theory - Gilligan's theory – consensus and controversy – Models of Professional Roles – theories about right action - Self-interest – customs and religion – uses of ethical theories.

UNIT III

ENGINEERING AS SOCIAL EXPERIMENTATION

6

Engineering as experimentation – engineers as responsible experimenters – codes of ethics – a balanced outlook on law – Case study: The challenger disaster.

UNIT IV

SAFETY, RESPONSIBILITIES AND IPR

6

Safety and risk – assessment of safety and risk – risk benefit analysis and reducing risk – Collegiality and loyalty – respect for authority - collective bargaining – confidentiality – conflicts of interest – occupational crime – professional rights – employee rights – Intellectual Property Rights (IPR) – discrimination. Case studies: The Three mile island and Chernobyl disaster

UNIT V

GLOBAL ISSUES

6

Multinational corporations - Environmental ethics – computer ethics – weapons development – engineers as managers – consulting engineers - engineers as expert witnesses and advisors - Code of Conduct – Corporate Social Responsibility

TOTAL: 30 PERIODS

TEXT BOOKS:

- 1 Mike W Martin and Roland Schinzinger, "Ethics in Engineering", 4th Edition, McGraw Hill, New York 2017.
- 2 Govindarajan M, Natarajan S and Senthil Kumar V S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2013.

REFERENCES:

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- 1 John R Boatright, "Ethics and the Conduct of Business", 4th Edition, Pearson Education, New Delhi, 2017.
- 2 Charles D and Fleddermann, "Engineering Ethics", Pearson Education, New Jersey, 2012.
- 3 Charles E Harris, Michael S Protchard and Michael J Rabins, "Engineering Ethics Concepts and Cases", 4th Edition, Wadsworth Thompson Learning, United States, 2005.

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

- C01** Comprehend the core human values that shape the ethical behaviour of an Engineer.
- C02** Apply ethics in the profession.
- C03** Summarize the structure and function of state government and local bodies.
- C04** Apply safety, responsibility and rights in workplaces.
- C05** Summarize the global issues with regard to ethics.

CO - PO - PSO MAPPING:

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

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U23MX02 ENVIRONMENTAL SCIENCES AND SUSTAINABILITY L T P C
 Prerequisites: Engineering Chemistry 2 0 0 0

COURSE OBJECTIVES:

- To introduce the basic concepts of environment, ecosystems and biodiversity and emphasize on the biodiversity of India and its conservation.
- To impart knowledge on the causes, effects and control or prevention measures of environmental pollution and natural disasters.
- To familiarize the concept of sustainable development goals and appreciate the interdependence of economic and social aspects of sustainability, recognize and analyze climate changes, concept of carbon credit and the challenges of environmental management.

UNIT I ENVIRONMENT AND BIODIVERSITY 6

Definition, scope and importance of environment – need for public awareness, Eco-system and Energy flow – ecological succession, Types of biodiversity: genetic, species and ecosystem diversity – values of biodiversity, India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ.

UNIT II ENVIRONMENTAL POLLUTION 6

Causes, Effects and Preventive measures of Water, Soil, Air and Noise Pollutions, Solid, Hazardous and E-Waste management. Case studies on Occupational Health and Safety Management system (OHSMS), Environmental protection, Environmental protection acts.

UNIT III RENEWABLE SOURCES OF ENERGY 6

Energy management and conservation; New Energy Sources: Need of new sources. Different types of new energy sources, Applications of Hydrogen energy, Ocean energy resources, Tidal energy conversion, Concept, origin and power plants of geothermal energy.

UNIT IV SUSTAINABILITY AND MANAGEMENT 6

Development, GDP, Sustainability – concept, needs and challenges-economic, social and aspects of sustainability-from unsustainability to sustainability-millennium development goals, and protocols Sustainable Development Goals – targets, indicators and intervention Areas Climate change – Global, Regional and local environmental issues and possible solutions-case studies, Concept of Carbon Credit, Carbon Footprint. Environmental management in industry – A case study.

UNIT V SUSTAINABILITY PRACTICES 6

Zero waste and R concept, Circular economy, ISO 14000 Series, Material Life cycle assessment, Environmental Impact Assessment. Sustainable habitat: Green buildings, Green materials, Energy efficiency, Sustainable transports. Sustainable energy: Non-conventional Sources, Energy Cycles, carbon cycle, emission and sequestration, Green Engineering: Sustainable urbanization- Socio-economical and technological change.

TOTAL: 30 PERIODS

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TEXT BOOKS:

- 1 Anubha Kaushik, C P Kaushik, "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers, 2018.
- 2 Benny Joseph, "Environmental Science and Engineering", 2nd Edition, Tata McGraw Hill, 2020.

REFERENCES:

- 1 Gilbert M Masters, "Introduction to Environmental Engineering and Science", 2nd Edition, Pearson Education, 2019.
- 2 R.K. Trivedi, "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", 2nd Edition, 2017.
- 3 Raja gopalan R, "Environmental Studies-From Crisis to Cure", 3rd Edition, Oxford University Press, 2015.

ONLINE WEB RESOURCES:

- 1 https://onlinecourses.nptel.ac.in/noc23_hs155/preview
- 2 <https://www.coursera.org/courses?query=environmental%20studies>
- 3 https://onlinecourses.swayam2.ac.in/ini24_es01/preview

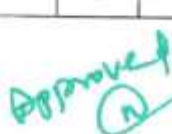
COURSE OUTCOMES:

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

- CO1** Explain the functions of environment, ecosystems and biodiversity and their conservation.
- CO2** Explain the causes, effects of environmental pollution and natural disasters and contribute to the preventive measures in the society.
- CO3** Comprehend renewable and non-renewable resources and contribute to the sustainable measures to preserve them for future generations.
- CO4** Summarize the different goals of sustainable development and apply them for suitable technological advancement and societal development.
- CO5** Explain the sustainability practices and identify green materials, energy cycles and the role of sustainable urbanization.

CO - PO - PSO MAPPING:

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

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U23CS504

SECURITY LABORATORY

L T P C

Prerequisites: Cryptography and Network Security

0 0 3 1.5

COURSE OBJECTIVES:

- To implement the different cipher techniques
- To implement the algorithms DES, RSA,MD5,SHA-1
- To learn and use network security tools and vulnerability Assessment tools

LIST OF EXPERIMENTS

1. Implement the following SUBSTITUTION & TRANSPOSITION TECHNIQUES concepts:
 - a) Caesar Cipher
 - b) Playfair Cipher
 - c) Hill Cipher
 - d) Vigenere Cipher
 - e) Rail fence – row & Column Transformation
2. Implement the TRANSPOSITION TECHNIQUE Rail fence - row & Column Transformation.
3. Apply DES Algorithm for practical applications
4. Apply AES Algorithm for practical applications
5. Implement RSA algorithm using HTML and Javascript
6. Implement the Diffie-Hellman Key Exchange algorithm for a given problem.
7. Calculate the message digest of a text using the SHA-1 algorithm.
8. Implement the SIGNATURE SCHEME - Digital Signature Standard.
9. Demonstrate intrusion detection system (ids) using any tool eg, Snort or any other software.
10. Automated Attack and Penetration Tools Exploring N-Stalker, a Vulnerability Assessment Tool

TOTAL: 45 PERIODS

Software Download Links:

- Visual Studio Code: <https://code.visualstudio.com/download>
- Snort - <https://www.snort.org/downloads>
- N-Stalker - <https://www.nstalker.com/products/editions/free/download/>
- JAVA - <https://www.java.com/en/download/>

COURSE OUTCOMES:

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

- CO1** Write encryption and decryption programs using substitution and transposition Techniques
- CO2** Apply AES and DES algorithm for key generation and encryption
- CO3** Write programs for authentication algorithms.

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CO4 Write programs for signature scheme using digital signature standard.

CO5 Apply vulnerability Assessment tools

CO - PO - PSO MAPPING:

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

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U23CS505 OBJECT ORIENTED ANALYSIS AND DESIGN LABORATORY L T P C
Prerequisites: Object Oriented Programming 0 0 3 1.5

COURSE OBJECTIVES:

- To capture the requirements specification for an intended software system.
- To draw the UML diagrams for the given specification.
- To improve the design by applying appropriate design patterns

Draw standard UML diagrams using an UML modelling tool for a given case study and map design to code and implement a 3 layered architecture. Test the developed code and validate whether the SRS is satisfied.

LIST OF EXPERIMENTS

1. Identify a software system that needs to be developed.
2. Document the Software Requirements Specification (SRS) for the identified system
3. Identify use cases and develop the Use Case model.
4. Identify the conceptual classes and develop a Domain Model and also derive a Class Diagram from that.
5. Using the identified scenarios, find the interaction between objects and represent them using UML Sequence and Collaboration Diagrams
6. Draw relevant State Chart and Activity Diagrams for the same system.
7. Implement the system as per the detailed design
8. Test the software system for all the scenarios identified as per the usecase diagram
9. Improve the reusability and maintainability of the software system by applying appropriate design patterns.
10. Implement the modified system and test it for various scenarios

SUGGESTED DOMAINS FOR CASE STUDY:

1. Passport automation system.
2. Book bank
3. Exam registration
4. Stock maintenance system.
5. Online course reservation system
6. Airline/Railway reservation system
7. Credit card processing
8. e-book management system
9. Library management system
10. Student information system

TOTAL: 45 PERIODS

Software Download Links:

- https://github.com/argouml-tigris-org/argouml/releases/tag/VERSION_0_34
- <https://gambas.soft112.com/>

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COURSE OUTCOMES:

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

- CO1 Explain Object Oriented analysis and design concept for a given problem specification.
- CO2 Describe the basic software requirements in UML mapping
- CO3 Analyze the interactions between objects and represent them using UML Sequence and Collaboration Diagrams for the given scenario.
- CO4 Analyze software quality using design patterns.
- CO5 Analyze the modified system and test it for various scenarios.

CO - PO - PSO MAPPING:

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

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- 6 a) Introduction to Raspberry PI platform and python programming
b) Log Data using Raspberry PI and upload to the cloud platform
- 7 Design an IOT based system

30 PERIODS
TOTAL: 75 PERIODS

TEXT BOOKS:

- 1 Muhammed Ali Mazidi, Janice Gillispie Mazidi, Rolin D McKinlay, "The 8051 Microcontroller and Embedded Systems", 2nd Edition, Pearson Education, 2019.
- 2 Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 3rd Edition, CISCO Press, 2017.

REFERENCES:

- 1 Wayne Wolf, "Computers as Components: Principles of Embedded Computer System Design", 2nd Edition, Elsevier, 2018.
- 2 Andrew N Sloss, D. Symes, C. Wright, "Arm System Developer's Guide", 1st Edition, Elsevier, 2020.

ONLINE WEB RESOURCES:

- 1 https://onlinecourses.nptel.ac.in/noc20_ee98/preview
- 2 <https://nptel.ac.in/courses/108102045>
- 3 <https://www.scribd.com/document/784454385/IOT-cho>

COURSE OUTCOMES:

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

- CO1 Explain the architecture of embedded processors
- CO2 Write embedded C programs.
- CO3 Design simple embedded applications.
- CO4 Design the communication models in IOT
- CO5 Design IoT applications using Arduino/Raspberry Pi /open platform.

CO - PO - PSO MAPPING:

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

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Prerequisite: Operating Systems

COURSE OBJECTIVES:

- To introduce the computation models and global state in distributed Systems.
- To describe distributed mutual exclusion and distributed deadlock detection techniques
- To summarize distributed shared memory and consensus recovery.

UNIT I DISTRIBUTED SYSTEMS BASICS AND COMPUTATION MODEL 9

Distributed System – Definition, Relation to computer system components, Motivation, Primitives for distributed communication, Design issues, Challenges and applications. A model of distributed computations – Distributed program, Model of distributed executions, Models of communication networks, Global state of a distributed system, Cuts of a distributed computation, Past and future cones of an event, Models of process communications.

UNIT II LOGICAL TIME, GLOBAL STATE AND TERMINATION DETECTION 9

Logical time – A framework for a system of logical clocks, Scalar time, Vector time. Leader election algorithm – Bully algorithm, Ring algorithm. Global state and snapshot recording algorithms – System model and definitions, Snapshot algorithm for FIFO channels – Chandy Lamport algorithm. Termination detection – System model of a distributed computation, Termination detection using distributed snapshots, Termination detection by weight throwing, Spanning-tree-based algorithm.

UNIT III MUTEX AND DEADLOCK DETECTION 9

Distributed mutual exclusion algorithms – System model, Requirements of mutual exclusion algorithm. Lamport’s algorithm, Ricart–Agrawala algorithm, Quorum-based mutual exclusion algorithms – Maekawa’s algorithm. Token-based algorithm – Suzuki–Kasami’s broadcast algorithm. Deadlock detection in distributed systems – System model, Deadlock handling strategies, Issues in deadlock detection, Models of deadlocks.

UNIT IV DISTRIBUTED SHARED MEMORY AND FAILURE RECOVERY 9

Distributed shared memory – Abstraction and advantages. Shared memory mutual exclusion – Lamport’s bakery algorithm. Check pointing and rollback recovery – System model, consistent and inconsistent states, different types of messages, Issues in failure recovery, checkpoint-based recovery, log-based roll back recovery.

UNIT V CONSENSUS AND DISTRIBUTED FILE SYSTEM 9

Consensus and agreement algorithms – Assumptions, The Byzantine agreement and other problems, Agreement in (message-passing) synchronous systems with failures – Consensus algorithm for crash failures. Distributed file system – File service architecture, Case studies: Sun Network File System, Andrew File System, Google File System.

TOTAL: 45 PERIODS

TEXT BOOKS:

- 1 Kshemkalyani Ajay D, Mukesh Singhal, “Distributed Computing: Principles, Algorithms and Systems”, 1st Edition, Cambridge Press, 2020.
- 2 Mukesh Singhal, Niranjana G Shivaratri, “Advanced Concepts in Operating systems”, 1st Edition, McGraw Hill Publishers, 2020.

REFERENCES:

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- 1 George Coulouris, Jean Dollimore, Time Kindberg, "Distributed Systems Concepts and Design", 5th Edition, Pearson Education, 2021.
- 2 Pradeep L Sinha, "Distributed Operating Systems: Concepts and Design", 2nd Edition, Prentice Hall of India, 2020.
- 3 Tanenbaum A S, Van Steen M, "Distributed Systems: Principles and Paradigms", 2nd Edition, Pearson Education, 2020.

ONLINE RESOURCES:

- 1 https://onlinecourses.nptel.ac.in/noc21_cs87/preview
- 2 <https://www.coursera.org/courses?query=distributed%20computing>
- 3 <https://www.techtarget.com/whatis/definition/distributed-computing>

COURSE OUTCOMES:

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

- CO1** Explain the foundations of distributed systems
CO2 Describe logical time, global state in distributed system
CO3 Comprehend mutex algorithms and deadlock detection techniques.
CO4 Describe shared memory techniques in distributed systems
CO5 Summarize working model of consensus and file system of distributed systems

CO - PO - PSO MAPPING:

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

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U23CB501

CYBER SECURITY

L T P C
3 0 2 4

COURSE OBJECTIVES:

- To understand the basics of cyber security, cyber crimes and cyber law.
- To learn about social media issues relevant to cyber security.
- To know about digital devices security, tools and technologies for cyber security.

UNIT I INTRODUCTION TO CYBER SECURITY 9

Defining Cyberspace and Overview of Computer and Web-technology, Architecture of cyberspace, Communication and web technology, Internet, World wide web, Concept of cyber security, Issues and challenges of cyber security.

UNIT II CYBERCRIME AND CYBER LAW 9

Classification of cyber crimes, Common cyber crimes- cyber crime targeting computers and mobiles, financial frauds, malware and ransomware attacks, zero day and zero click attacks, Reporting of cyber crimes, Remedial and mitigation measures, Legal perspective of cyber crime, IT Act 2000 and its amendments, Cyber crime and offences, Organisations dealing with Cyber security in India.

UNIT III SOCIAL MEDIA OVERVIEW AND SECURITY 9

Introduction to Social networks. Types of Social media, Social media platforms, Social media monitoring, Social media privacy, Security issues related to social media, Flagging and reporting of inappropriate content, Laws regarding posting of inappropriate content, Best practices for the use of Social media, Case studies.

UNIT IV E - COMMERCE AND DIGITAL PAYMENTS 9

E- Commerce, Elements of E-Commerce security, E-Commerce threats, E-Commerce security best practices, Introduction to digital payments, Components of digital payment, Modes of digital payments - Banking Cards, Unified Payment Interface (UPI), e-Wallets, Unstructured Supplementary Service Data (USSD), Digital payments related common frauds and preventive measures. RBI guidelines on digital payments and customer protection in unauthorised banking transactions.

UNIT V DIGITAL DEVICES SECURITY, TOOLS AND TECHNOLOGIES FOR CYBER SECURITY 9

Mobile phone security, Password policy, Security patch management, Data backup, Downloading and management of third party software, Device security policy, Significance of host firewall and Ant-virus, Management of host firewall and Anti-virus, Wi-Fi security.

45 PERIODS

PRACTICAL EXERCISES:

- 1 Checklist for reporting cyber crime at cyber crime Police Station and reporting cyber crime online.
- 2 Configuring security settings in Mobile Wallets and UPIs and Checklist for secure net banking.
- 3 Setting and configuring two factor authentication in the Mobile phone and Security patch management and updates in Computer and Mobiles.
- 4 Managing Application permissions in Mobile phone.
- 5 Wi-Fi security management in computer and mobile.

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30 PERIODS

TOTAL: 75 PERIODS

REFERENCES:

- 1 Ramesh Chandra Mishra, "Cyber Crime Impact in the New Millennium", Authors Press, 2010.
- 2 Sumit Belapure, Nina Godbole, "Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", 1st Edition, Wiley India Pvt. Ltd., 2011.
- 3 Kumar K, "Cyber Laws: Intellectual Property & E-Commerce Security", Dominant Publishers, 2011.
- 4 Eric Cole, Ronald Krutz, James W Conley, "Network Security Bible", 2nd Edition, Wiley India Pvt. Ltd., 2011.
- 5 E Maiwald, "Fundamentals of Network Security", Tata McGraw Hill, 2017.

ONLINE RESOURCES

- 1 <http://www.digimat.in/nptel/courses/video/106106212/L01.html>
- 2 https://onlinecourses.swayam2.ac.in/cec24_cs03/preview
- 3 https://onlinecourses.swayam2.ac.in/cec24_cs01/preview

COURSE OUTCOMES:

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

- CO1** Explain the concept of Cyber security and issues and challenges associated with it.
CO2 Explain cyber crimes, their nature, legal remedies and as to how report the crimes through available platforms and procedures.
CO3 Apply various privacy and security concerns on online Social media.
CO4 Apply concepts related cyber security aspects to E-Commerce and digital payments.
CO5 Apply Wi-Fi security management concepts in computer and mobile.

CO - PO - PSO MAPPING:

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

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U23EEC601

EMPLOYABILITY SKILLS - IV

L T P C

Prerequisites: Nil

0 0 2 1

COURSE OBJECTIVES:

- To educate and enrich the students on quantitative aptitude, logical reasoning and verbal communication.

UNIT I **ADVANCED QUANTITATIVE APTITUDE - 1** **6**
Averages - problem on Ages - Ratio & Proportion - Mixture and Allegations.

UNIT II **ADVANCED QUANTITATIVE APTITUDE - 2** **6**
Percentages - Profit and Loss - Simple Interest & Compound Interest - logarithms.

UNIT III **ADVANCED QUANTITATIVE APTITUDE - 3** **6**
Algebra - Linear Equation - Quadratic equation - Polynomials - Time and Distance - Problems on train - Time and Work.

UNIT IV **ADVANCED LOGICAL REASONING** **6**
Coding and decoding - Blood relations - Direction Series - Syllogism - puzzles.

UNIT V **ADVANCED VERBAL COMMUNICATION** **6**
Error Spotting - Jumbled Sentences - Comprehension - Idioms and Phrases - Synonyms and Antonyms.


TOTAL: 30 PERIODS

TEXT BOOKS:

- 1 R S Aggarwal, "Quantitative Aptitude", Revised Edition, S Chand & Co Ltd., 2017.
- 2 R S Aggarwal, "A Modern Approach to Verbal and Non-verbal Reasoning", S Chand & Co Ltd., 2018.

REFERENCES:

- 1 Abhijit Guha, "Quantitative Aptitude", 3rd Edition, Tata McGraw Hill, 2009.
- 2 Raj N Bakshmi, "English Grammar Practice," 1st Edition, Orient Black Swan, 2009.
- 3 M Ashra Rizvi, "Effective Technical Communication," 2nd Edition, Tata McGraw Hill, 2017.
- 4 Norman Lewis, "Word Power Made Easy", W.R. Goyal Publishers, 2020.

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U23CS701

CLOUD COMPUTING

L T P C

Prerequisites: Computer Networks

3 0 0 3

COURSE OBJECTIVES:

- To understand the principles of cloud architecture, model, infrastructure, concepts of Virtualization and virtual machines.
- To gain knowledge about virtualization Infrastructure, explore and experiment with various Cloud deployment environments.
- To learn about the security issues in the cloud environment.

UNIT I CLOUD ARCHITECTURE MODELS AND INFRASTRUCTURE 9

Cloud Architecture: NIST Cloud Computing Reference Architecture – Cloud deployment models – Cloud service models; Cloud Infrastructure: Architectural Design of Compute and Storage Clouds – Design Challenges.

UNIT II VIRTUALIZATION BASICS 9

Virtual Machine Basics – Taxonomy of Virtual Machines – Hypervisor – Key Concepts – Virtualization structure – Implementation levels of virtualization – Virtualization Types: Full Virtualization – Para Virtualization – Hardware Virtualization – Virtualization of CPU, Memory and I/O devices.

UNIT III VIRTUALIZATION INFRASTRUCTURE AND DOCKER 9

Desktop Virtualization – Network Virtualization – Storage Virtualization – System- level of Operating Virtualization – Application Virtualization – Virtual clusters and Resource Management – Containers vs. Virtual Machines – Introduction to Docker – Docker Components – Docker Container.

UNIT IV CLOUD DEPLOYMENT ENVIRONMENT 9

Google App Engine – Amazon AWS – Microsoft Azure; Cloud Software Environments – Eucalyptus – OpenStack.

UNIT V CLOUD SECURITY 9

Virtualization System-Specific Attacks: Guest hopping – VM migration attack – hyper jacking. Identity and Access Management (IAM) - IAM Challenges - IAM Architecture.

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", 1st Edition, Morgan Kaufmann Publishers, 2018.
- 2 Rajkumar Buyya, Christian Vecchiola, S Thamarai Selvi, "Mastering Cloud Computing ", 2nd Edition, Tata McGraw Hill, 2023

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REFERENCES:

- 1 James E Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", 2nd Edition, Elsevier, 2005.
- 2 Tim Mather, Subra Kumaraswamy, Shahed Latif, "Cloud Security and Privacy: an enterprise perspective on risks and compliance", 2nd Edition, O'Reilly Media, 2009.
- 3 James Turnbull, "The Docker Book", 2nd Edition, O'Reilly Media, 2018.

ONLINE RESOURCES:

- 1 <https://aws.amazon.com/what-is/virtualization>
- 2 <https://archive.nptel.ac.in/courses/106/105/106105167/>
- 3 <https://www.coursera.org/specializations/cloud-computing>

COURSE OUTCOMES:

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

- CO1** Comprehend the principles behind cloud architecture and design challenges.
- CO2** Describe the concepts of virtualization and its types..
- CO3** Analyze Virtualization in hardware resources and Docker.
- CO4** Analyze various Cloud services and setup a cloud environment.
- CO5** Explain various security challenges in cloud environment.

CO - PO - PSO MAPPING:

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

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U23AI502

BIG DATA ANALYTICS

L T P C

Prerequisites: Data Mining and warehousing

3 0 0 3

COURSE OBJECTIVES:

- To understand big data and Hadoop.
- To learn and use NoSQL big data management and map reduce analytics using Hadoop and related tools.
- To understand the usage of Hive and Hbase

UNIT I INTRODUCTION OF BIG DATA 9

Introduction to big data - convergence of key trends - unstructured data - web analytics - big data applications- big data technologies - introduction to Hadoop - open source technologies - cloud and big data - Crowd sourcing analytics - inter and trans firewall analytics.

UNIT II NOSQL DATA MANAGEMENT AND CASSANDRA 9

Introduction to NoSQL - aggregate data models - key-value and document data models - relationships - graph databases - schema less databases -distribution models - master- slave replication - Cassandra - Cassandra data model - Cassandra examples - Cassandra clients.

UNIT III BASICS OF HADOOP CONCEPTS 9

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

UNIT IV MAP REDUCE APPLICATIONS 9

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

UNIT V HBASE AND HIVE DATA MODELS 9

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

TOTAL:45 PERIODS

TEXT BOOKS:

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- 1 Michael Minelli, Michelle Chambers, AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", 1st Edition, John Wiley & Sons, 2013.
- 2 Eric Sammer, "Hadoop Operations", 1st Edition, O'Reilly Media, 2012.

REFERENCES:

- 1 E. Capriolo, D. Wampler, J Rutherglen, "Programming Hive", 1st Edition, O'Reilly Media, 2012.
- 2 Lars George, "HBase: The Definitive Guide", 1st Edition, O'Reilly Media, 2011.
- 3 Alan Gates, "Programming Pig", 1st Edition, O'Reilly Media, 2011.

ONLINE RESOURCES:

- 1 <https://www.digimat.in/nptel/courses/video/106104189/L07.html>
- 2 <https://www.coursera.org/specializations/big-data>
- 3 <https://archive.nptel.ac.in/courses/106/104/106104189/>

COURSE OUTCOMES:

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

- CO1** Describe big data and Hadoop introduction.
- CO2** Summarize NoSQL big data management and Cassandra
- CO3** Design, configure and run Hadoop and HDFS..
- CO4** Solve map-reduce analytics using Hadoop.
- CO5** Apply Hadoop-related tools such as HBase, Cassandra, Hive

CO - PO - PSO MAPPING:

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

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- 1 Gobalakrishnan P, Ramamoorthy V E, "Textbook of Project Management", 7th Edition, Trinity Press, 2014.
- 2 Harvey Maylor, "Project Management", 3rd Edition, Pearson Education, 2010.

REFERENCES:

- 1 James P Clements, Jack Gido, "Effective project management", 3rd Edition, Cengage Learning, 2008.
- 2 Clifford F Gray, Erik W Larson, "Project Management: The Managerial Process", 3rd Edition, Tata McGraw-Hill, 2010.
- 3 Sadhan Choudhury, "Project Management", 1st Edition, Tata McGraw-Hill, 2007.

ONLINE RESOURCES:

- 1 <https://archive.nptel.ac.in/courses/110/104/110104073>
- 2 <https://www.udemy.com/course/beginning-project-management-project-management-level-one>
- 3 <https://www.coursera.org/learn/financial-markets-global>

COURSE OUTCOMES:

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

- C01** Explain the concept of operational and project management.
- C02** Define the scope of a project and develop the project plan.
- C03** Evaluate the technical, business and social environment related to the project.
- C04** Explain team formulation and successful team management.
- C05** Design projects using tools and techniques.

CO - PO - PSO MAPPING:

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

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GOWRIVAKKAM, CHENNAI - 600 073.

U23CS702

CLOUD COMPUTING LABORATORY

L T P C

Prerequisites: Computer Networks Lab

0 0 3 1.5

COURSE OBJECTIVES:

- To install and use Virtual box/VMware/ Equivalent open source cloud Workstation that can be used as different flavours of Linux or Windows OS
- To install Google App Engine and develop web application GAE Launch and simulate a Cloud environment to implement scheduling algorithm using CloudSim.
- To install Hadoop and run simple applications & Creating, Executing and run Container Using Docker.

LIST OF EXPERIMENTS

1. Install Virtualbox/VMware/ Equivalent open-source cloud Workstation with different flavors of Linux or Windows OS on top of windows 8 and above.
2. Install a C compiler in the virtual machine created using a virtual box and execute Simple Programs
3. Install Google App Engine. Create a hello world app and other simple web applications using python/java.
4. Use the GAE launcher to launch the web applications.
5. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim
6. Find a procedure to transfer the files from one virtual machine to another virtual machine.
7. Install Hadoop single node cluster and run simple applications like wordcount.
8. Creating and Executing Your First Container Using Docker.
9. Run a Container from Docker Hub

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

- CO1** Apply Virtual box/VMware/ Equivalent open source cloud Workstation that can be used in Linux or Windows OS.
- CO2** Apply Google App Engine and develop web application GAE Launch
- CO3** Design cloud environment to implement scheduling algorithm using CloudSim.
- CO4** Apply Hadoop to run simple applications.
- CO5** Create, Execute and run Container Using Docker.

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WARRANGAL, Andhra Pradesh

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 | - | 1 | 2 | 2 |
| CO2 | 3 | 3 | 3 | 3 | 2 | - | - | 1 | 1 | 1 | - | 1 | 2 | 2 |
| CO3 | 3 | 3 | 3 | 3 | 2 | - | - | 1 | 1 | 1 | - | 1 | 2 | 2 |
| CO4 | 3 | 3 | 3 | 3 | 2 | - | - | 1 | 1 | 1 | - | 1 | 2 | 2 |
| CO5 | 3 | 3 | 3 | 3 | 2 | - | - | 1 | 1 | 1 | - | 1 | 2 | 2 |

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U23IAI505

BIG DATA ANALYTICS LABORATORY

L T P C
0 0 3 1.5

Prerequisites: Data Science Lab

COURSE OBJECTIVES:

- To understand setting up of Hadoop Cluster
- To solve problems using MapReduce Technique
- To solve Big Data problems

LIST OF EXPERIMENTS

1. Set up a pseudo-distributed, single-node Hadoop cluster backed by the Hadoop Distributed File System, running on Ubuntu Linux. After successful installation on one node, configuration of a multi-node Hadoop cluster (one master and multiple slaves).
2. MapReduce application for word counting on Hadoop cluster
3. Unstructured data into NoSQL data and do all operations such as NoSQL query with API.
4. K-means clustering using map reduce
5. Page Rank Computation
6. Mahout machine learning library to facilitate the knowledge build up in big data analysis.
7. Application of Recommendation Systems using Hadoop/mahout libraries.
8. Implementation of Matrix Multiplication using Hadoop Map Reduce.
9. Hadoop implementation of file management tasks such as adding a file, retrieving and deleting files.
10. Practice exporting and importing of data from various databases.

TOTAL:45PERIODS


COURSE OUTCOMES:

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

- CO1** Install, configure and run Hadoop and HDFS.
- CO2** Apply the set up multi-node Hadoop Clusters.
- CO3** Apply Map Reduce algorithms for various algorithms.
- CO4** Design new algorithms that uses Map Reduce
- CO5** Apply on Unstructured and structured data.

CO - PO - PSO MAPPING:

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

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| PROFESSIONAL ELECTIVE COURSES : VERTICALS | | | | | | | | | | | |
|---|---|-------------|--|-------------|----------------------------------|-------------|---|-------------|---------------------------------|-------------|--|
| Course Code | Vertical I | Course Code | Vertical II | Course Code | Vertical III | Course Code | Vertical IV | Course Code | Vertical V | Course Code | Vertical VI |
| | Visual and Interactive Multimedia Tecnologies | | Computational Perceptions | | Web-Based Software Development | | Digital Transformation Technologies | | Cloud Computing | | Artificial Intelligence & Machine Learning |
| U23PECS01 | Multimedia Communication & Networking | U23PECS07 | Computer Vision & Image Processing | U23PECS13 | Web-based technologies | U23PECS19 | Digital Transmission | U23PECS25 | Enterprise Service Architecture | U23PECS31 | Artificial Intelligence for Robotics |
| U23PECS02 | User Interface Design | U23PECS08 | Neural Networks and Deep Learning | U23PECS14 | Application building | U23PECS20 | Database Security | U23PECS26 | Soft Computing Techniques | U23PECS32 | Fundamentals of Computational intelligence |
| U23PECS03 | Multimedia Design Programming | U23PECS09 | AI for Cyber Security | U23PECS15 | Cloud system management | U23PECS21 | Multimedia Data Compression and Storage | U23PECS27 | Green Computing | U23PECS33 | Advanced Business Intelligence & Analytics |
| U23PECS04 | Computer Graphics | U23PECS10 | AI Tools for Natural Language Processing | U23PECS16 | Interaction design | U23PECS22 | Technological Systems Visualization | U23PECS28 | Cloud Service Managemnet | U23PECS34 | Artificial Intelligence and Expert Systems |
| U23PECS05 | Computer Modelling & Animation | U23PECS11 | Nature & Bio - Inspired Computing | U23PECS17 | Quality assurance and automation | U23PECS23 | Computer Imaginatives | U23PECS29 | Parallel Computing | U23PECS35 | Artificial Neural networks |
| U23PECS06 | Multimedia Security | U23PECS12 | Feature Engineering | U23PECS18 | Web application protection | U23PECS24 | Video Creation and Editing | U23PECS30 | Social Network Analysis | U23PECS36 | Advanced Machine Learning Techniques |


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ONLINE RESOURCES:

- 1 <https://nptel.ac.in/courses/106/105/106105082>
- 2 <https://www.coursera.org/learn/packt-communication-and-network-security-kceeu>
- 3 <https://onlinelibrary.wiley.com/MultimediaNetworks/doi/book/10.1002/9781119090151>

COURSE OUTCOMES:

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

- CO1** Summarize multimedia networking terminologies and components.
CO2 Comprehend various compression techniques
CO3 Describe functions of various transport protocols.
CO4 Summarize Broadband ATM networks
CO5 Describe the communication across different networking system

CO - PO - PSO MAPPING:

| | P01 | P02 | P03 | P04 | P05 | P06 | P07 | P08 | P09 | P010 | P011 | P012 | PS01 | PS02 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 2 | 2 | 1 | 1 | - | - | - | - | - | - | - | - | 2 | 2 |
| CO2 | 2 | 2 | 1 | 1 | - | - | - | - | - | - | - | - | 3 | 2 |
| CO3 | 2 | 2 | 1 | 1 | - | - | - | - | - | - | - | - | 2 | 2 |
| CO4 | 2 | 2 | 1 | 1 | - | - | - | - | - | - | - | 1 | 2 | 3 |
| CO5 | 2 | 2 | 1 | 1 | - | - | - | 1 | - | - | - | - | 3 | 3 |

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U23PECS02

USER INTERFACE DESIGN

L T P C

Prerequisites : Web Technology

3 0 0 3

COURSE OBJECTIVES:

- To understand the relation between interaction design, user's expectations
- To learn about the prototype includes usability heuristics.
- To understand user interface design techniques for multiscreen design.

UNIT I INTERACTION DESIGN 9

Introduction, Good and Poor design, Interaction design, User experience, Process of Interaction design, Interaction design and User experience.

UNIT II DEVELOPMENT PROCESS 9

Managing design process – organizational design to support usability – Four phases of design – development methodologies – Ethnographical observation – Participatory design – scenario development. Develop System Menus and Navigation menus-Select the proper kinds of windows-Select the proper device based controls.

UNIT III PROTOTYPING AND CONSTRUCTION 9

Process of Interaction Design – Establishing Requirements – Design, Prototyping and Construction – Evaluation and Framework. Usability Heuristics – Simple and Natural Dialogue, Users' Language, Memory Load, Consistency, Feedback, Clearly Marked Exits, Shortcuts, Error Messages, Prevent Errors, Documentation, Heuristic Evaluation.

UNIT IV PLATFORM AND POSTURE 9

Designing Desktop Software, Web sites, Web Applications, Internet- enabled Applications, Intranet – Other Platforms Handhelds, Kiosks, Television-based Interfaces, Automotive Interfaces, Appliances, Audible Interfaces.

UNIT V MUTISCREEN UX 9

Four Screens – Context of use – Strategies – Mobile First, Simultaneity, Social TV, Device Shifting, Complementarity, Synchronization, Screen Sharing, Coherence, Fluidity, Smart Content, Communication, Mashability, Gamification – Hybrid Media- Technical Challenges. Case Study – Tool Study.

TOTAL: 45 PERIODS

TEXT BOOKS:

- 1 Ben Shneiderman, Catherine Plaisant, "Designing the User Interface: Strategies for Effective Human-Computer Interaction", 6th Edition, Pearson Education , 2018
- 2 Wilbert O Galitz, "The Essential Guide to User Interface Design: An Introduction to GUI Design Principles and Techniques", 3rd Edition, Wiley Publishing, 2017.

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REFERENCES:

- 1 Alan Cooper, Robert Reimann, and Dave Cronin, "About Face 3 The Essentials of Interaction Design", John Wiley & Sons, 2017.
- 2 Wolfram Nagel, "Multiscreen UX Design Developing for a Multitude of Devices", Elsevier, 2013.
- 3 Wilbert O. Galitz, "The Essential Guide to User Interface Design", 2nd Edition, John Wiley & Sons, 2018.

ONLINE RESOURCES:

- 1 <https://archive.nptel.ac.in/courses/106/103/106103237>
- 2 <https://www.coursera.org/coursera-ux-design-toolkit>
- 3 <https://www.classcentral.com/course/interaction-design-18758>

COURSE OUTCOMES:

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

C01 Describe interaction design pattern for a particular user interface Situation.

C02 Summarize the user inputs in design patterns development process.

C03 Comprehend the interface prototypes based on the design process.

C04 Analyze the user needs for developing appropriate interface design.

C05 Apply the concepts UX for a real time application.

CO – PO – PSO MAPPING:

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

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U23PECS03 MULTIMEDIA DESIGN PROGRAMMING

L T P C

Prerequisites : Python programming

3 0 0 3

COURSE OBJECTIVES:

- To learn the basic operations and tools in Adobe flash workspace
- To understand working of symbols and animations and special effects in Flash
- To learn interactive application development using flash.

UNIT I UNDERSTAND THE FLASH WORKSPACE 9

Open a Document and Play a Flash Movie- Create and Save a Flash Movie - Work with the timeline - Distribute a Flash Movie Application.

UNIT II DRAWING OBJECTS IN ADOBE FLASH 9

Use the Flash Drawing and Alignment Tools- Select Objects and Apply Colors - Work with Drawn Objects - Abik with Text and Text Objects - Work with layers and Objects.

UNIT III WORKING WITH SYMBOLS AND INTERACTIVITY 9

Create Symbols and Instances- Work with libraries - Create Buttons - Assign Actions to Frames and Buttons -Import Graphics.

UNIT IV CREATING ANIMATIONS AND SPECIAL EFFECTS 9

Create Motion Tween Animations- Create Classic tween animation - Create Frame- by-Frame Animations -Create Shape tween Animations - Create Movie Animate Text - Create A Mask Effect - Add Sound - Add Video - Create an Animated navigation Bar - Create Character Animations Using Inverse Kinematics - Create 3D Effects - Use the Deco Tool.

UNIT V PREPARING AND PUBLISHING APPLICATIONS 9

Partial ordering – Posets – Lattices as posets – Properties of lattices - Lattices as algebraic systems – Sub lattices – Direct product and homomorphism – Some special lattices – Boolean algebra.

TOTAL: 45 PERIODS

TEXT BOOKS:

- 1 James Shuman," Adobe Flash CS6 (Revealed)", 1st Edition, A Press, 2021.
- 2 Joseph Labrecque," Learning Adobe Edge Animate", 1st Edition, Pearson Education, 2022.

REFERENCES:

- 1 William Sanders," Learning PHP Design Patterns", 1st Edition, O'Reilly Media, 2021.
- 2 Vic Costello,"Multimedia Foundations", 1st Edition, Focal Press, 2020.

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ONLINE RESOURCES:

- 1 <https://nptel.ac.in/courses/117105083>
- 2 <https://www.domestika.org/en/courses/area/45-multimedia>
- 3 <https://www.bmcc.cuny.edu/academics/departments/media-arts-and-technology>

COURSE OUTCOMES:

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

- CO1** Describe the basic operations in Adobe flash workspace.
- CO2** Summarize various tools for drawing of objects.
- CO3** Design simple media applications with symbols and interactions.
- CO4** Apply animation techniques and special effects in media applications
- CO5** Design flash applications for desktops and mobiles.

CO - PO - PSO MAPPING:

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


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U23PECS04

COMPUTER GRAPHICS

L T P C

Prerequisites :Linear Algebra and Calculus, C Programming

2 0 2 3

COURSE OBJECTIVES:

- To learn two dimensional and three dimensional objects and various color models
- To learn rendering techniques, scene graph representation and transformations
- To learn kinematics in animation.

UNIT I TWO DIMENSIONAL AND THREE DIMENSIONAL CONCEPTS 7

Two-dimensional Geometric transformation - Two-dimensional viewing - Line, Polygon, Curve and Text clipping algorithms- Three-dimensional object representation-Polygons, Curved lines, Quadric Surfaces.

UNIT II COLOR MODELS 5

Color Models - RGB, YIQ, CMY, HSV - Animations - Conversation between HSV and RGB Models-HLS Color Model-Color Selection and Applications

UNIT III RENDERING 6

Introduction to Shading models - Flat and Smooth shading - Adding texture to faces -Adding shadows of objects - Building a camera in a program - Creating shaded objects - Rendering texture - Drawing Shadows

UNIT IV SCENE GRAPHS 6

Basic structure - Transformation hierarchy - Relative Transformations – Bounding Volume Hierarchy – Sample Implementation: Group node, Object Node, Camera Node.

UNIT V SKELETAL ANIMATION AND KINEMATICS 6

Articulated Character Models – Vertex Blending – Skeleton and Skin – Vertex Skinning - Robot Manipulators – Forward Kinematics – Linear and Angular Velocity – Inverse Kinematics

30 PERIODS

PRACTICAL EXERCISES

- 1 To implement 2D Geometric transformations
- 2 Implement clipping algorithms for lines, polygons, curves, and text.
- 3 Write a program to input HSV values, convert them to RGB
- 4 Implement Flat Shading on a 3D object
- 5 Apply a basic texture (image) onto a cube's faces using UV coordinates

30 PERIODS

TOTAL: 60 PERIODS

TEXT BOOKS:

- 1 James D Foley, Andries Van Dam, "Computer Graphics- Principles and practice", Pearson Education, 2nd Edition, 2020.
- 2 Donald Hearn, Pauline Baker, "Computer Graphics with OpenGL- C Version", Pearson Education, 4th Edition, 2020.

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REFERENCES:

- 1 Foley, Vandam, Feiner Hughes, "Computer Graphics: Principles and Practice", 2nd Edition, Pearson Education, 2018.
- 2 S Chand, Rajiv Chopra "Computer Graphics with Introduction to Multimedia, Pearson Education, 4th Edition, 2019.
- 3 Plastock, "Computer Graphics", 2nd Edition, Tata McGraw Hill, 2019

ONLINE RESOURCES:

- 1 https://nptel.ac.in/noc20_cs90/
- 2 <https://www.coursera.org/learn/interactive-computer-graphics>
- 3 <https://www.edx.org/learn/computer-graphics>

COURSE OUTCOMES:

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

- CO1** Create two dimensional and three dimensional geometric transformations
CO2 Describe various color models
CO3 Apply efficient rendering techniques
CO4 create relative transformation using scene graphs
CO5 Apply kinematics animation.

CO - PO - PSO MAPPING:

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

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U23PECS05

COMPUTER MODELING AND ANIMATION

L T P C

Pre requisites :Computer Graphics

2 0 2 3

COURSE OBJECTIVES:

- To learn 3D elements and solid modeling
- To become familiar with lighting Concepts
- To learn animation concepts and frames

UNIT I

INTRODUCTION TO 3D ELEMENTS AND CREATION

7

Coordinate system, vertex, faces and object - Concept of wireframe, surface and solid modeling
Creating primitive objects and patches- Modification methods and transformation of 3D objects - Creating primitives using keyboard and dimensional control.

UNIT II

SOLID MODELING AND MATERIAL EDITOR

5

Creating shapes by lofting - Integrating shape and path to create complex objects - Solid modeling using Boolean Operations - Boolean parameters and sub-level modifications - Creating object using NURBS - Animation using various modifiers - Definition of materials and overview of Material Editor interface - Basic materials, color and shading - Designing basic standard materials.

UNIT III

LIGHTING

6

Properties of light - Natural and Artificial Lights - Creating light object; Omni lights, target spotlights and free spotlights - Setting light color - Setting the shadow properties of an object.

UNIT IV

ANIMATION

6

Animation - Stop Motion Photo Animation - Zoetrope - Thaumatrope - Cell and Paper Animation - Types of Animation - Facial expressions Flash Overview - Adobe Animate Interface - Menu Bar, Tools - Layers - Property Inspector - Timeline - Stage - Scene - File Formats: .fla, .swf - Library - Import to the stage - Color Swatches - Grid, Guide & Rulers - Creating New Document - Working on Stage.

UNIT V

WORKING WITH FRAMES

6

Filters, Shape Tween, Shape Hint Tween, Masking, Layer Mask, Ease in and Ease out Animation, Working Frame - by - Frame Animations, Working on Tween Animation, Character creation - Animation - Creating Storyboard, Creating any Cartoon Character, Creating Background Scenes, Using Bone Setup Tool, Lip Movements, Adding Audio to Scene, Publish Movie, Publish Setting.

30 PERIODS

PRACTICAL EXERCISES:

- 1 Creating Web Banners in Adobe Flash
- 2 Creating a Logo Animation in Adobe Flash
- 3 Creating Frame by Frame animation
- 4 Draw Cartoon Animation using reference.

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- 5 Create Lip Sink to Characters
- 6 Using filters & Special effects
- 7 Create a scene by using Mask layers animation

30 PERIODS
TOTAL :60 PERIODS

TEXT BOOKS:

- 1 John M, Blain, "The Complete Guide to Blender Graphics Computer Modeling & Animation", 8th Edition, Pearson Education, 2022
- 2 Magesh Chandramouli, "3D Modeling & Animation", 1st Edition, CRC Press, 2020

REFERENCES:

- 1 Wayne E. Carlson, "Computer Graphics and Animation", 2nd Edition, Pearson Education, 2017.
- 2 S Chand, Rajiv Chopra "Computer Graphics with Introduction to Multimedia, Pearson Education, 4th Edition, 2019.
- 3 John M. Blain, "The Complete Guide to Blender Graphics: Computer Modeling & Animation", 6th Edition, CRC Press, 2021.

ONLINE RESOURCES:

- 1 <https://nptel.ac.in/courses/106/106/106106090/>
- 2 https://www.cse.iitm.ac.in/~vplab/courses/computer_graphics.html
- 3 <https://www.coursera.org/courses?query=computer%20animation>


COURSE OUTCOMES:

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

- CO1** Describe 3D elements and creating primitive objects
- CO2** Summarize solid modeling and Material editor
- CO3** Describe properties of light and creating light object
- CO4** Comprehend animation and types of animation
- CO5** Create various animations using frames

CO - PO - PSO MAPPING:

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


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U23PECS06

MULTIMEDIA SECURITY

L T P C

Prerequisites : Multimedia Design Programming

3 0 0 3

COURSE OBJECTIVES:

- To understand the basic digital rights management systems and security applications
- To learn embedded multimedia system architecture, multimedia mining and classification
- To explore the underlying security mechanisms needed to implement security countermeasures.

UNIT I FUNDAMENTALS OF MULTIMEDIA SECURITY 9

Overview of Digital rights management systems, multimedia encryption, multimedia authentication, key management for multimedia authentication and distribution

UNIT II MULTIMEDIA SECURITY APPLICATIONS 9

An overview of Digital watermarking, Biometrics in Digital rights management, Steganalysis, passive blind image forensics, security in digital cinema

UNIT III EMBEDDED MULTIMEDIA SECURITY 9

Video coding, embedded systems and reconfigurable architectures and encryption basics.

UNIT IV MULTIMEDIA MINING AND CLASSIFICATION 9

Multimedia Duplicate Mining toward Knowledge Discovery, Discriminative Learning - Assisted Video Semantic concept classification, Improved Feature Vocabulary-Based Method for Image Categorization

UNIT V FORENSICS 9

Multimedia Forensics: Digital Forensics taxonomy, goals/requirements - Forensic Data Acquisition - Digital Forensics Tools -Forensics Analysis and Validation-Application forensics-Email, Graphics and Multimedia Forensics.

TOTAL: 45 PERIODS

TEXT BOOKS:

- 1 Wenjun Zeng, Heather Yu, Ching-Yung Lin, "Multimedia Security Technologies for Digital Rights Management", 2nd Edition, Academic Press, 2021.
- 2 Amit Pande, Joseph Zambreno, "Embedded Multimedia Security Systems: Algorithms and Architectures", 2nd Edition, Springer , 2022.

REFERENCES:

- 1 Chun-Shien Lu, "Multimedia Security: Steganography and Digital Watermarking techniques for Protection of Intellectual Property", 2nd Edition, Academic Press, 2016.
- 2 B Furht, D Kirovski, "Multimedia Security Handbook", 2nd Edition, CRC press, 2014.
- 3 S Chand, "The Complete Guide to Blender Graphics", 4th Edition, Tata McGraw Hill, 2021

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ONLINE RESOURCES:

- 1 <https://nptel.ac.in/courses/117105083>
- 2 <https://cse.nitk.ac.in/course/multimedia-security>
- 3 <https://www.appleacademicpress.com/multimedia-security-tools-techniques>

COURSE OUTCOMES:

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

- CO1** Describe the digital rights management systems in multimedia security.
- CO2** Summarize the requirements and mechanisms for identification and authentication.
- CO3** Comprehend the need for embedded multimedia security using a real time case study.
- CO4** Describe multimedia mining in various multimedia applications.
- CO5** Comprehend multimedia forensics tools and applications of forensics.

CO - PO - PSO MAPPING:

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

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U23PECS07

COMPUTER VISION AND IMAGE PROCESSING

L T P C

Prerequisites: Python programming

3 0 0 3

COURSE OBJECTIVES:

- To understand the importance fundamentals of Image processing and Computer vision.
- To explore various Image Formation, Image Enhancement and Segmentation.
- To understand the core vision tasks through Motion estimation and Object as well as pattern recognition.

UNIT I

INTRODUCTION

6

Digital Image fundamentals, Image Sensing and acquisition, Sampling and Quantization, Image formation models, Overview of Computer Vision, Applications of Image processing and Computer Vision

UNIT II

IMAGE ENHANCEMENT

10

Image enhancement in spatial domain, Basic grey level Transformations, Histogram Processing Techniques, Spatial Filtering, Image smoothing and Image Sharpening, Image enhancement process in frequency domain, Low pass filtering, High pass filtering.

UNIT III

IMAGE SEGMENTATION AND FEATURE EXTRACTION

12

Image Segmentation: point, line and edge detection, Thresholding, Regions Based segmentation, Edge linking and boundary detection Feature Extraction: Importance of Features, Feature extraction techniques, Histogram of Oriented Gradient (HOG), Scale Invariant Feature Transform (SIFT), Background subtraction techniques, Image Matching, Principal Component Analysis (PCA)

UNIT IV

OBJECT RECOGNITION AND MOTION ESTIMATION

12

Object Recognition techniques: Viola-Jones, Yolo, Deep learning algorithms for Object Recognition. Optical Flow, Gaussian Mixture Model (GMM), Structure of Motion, Motion Estimation.

UNIT V

APPLICATIONS OF IMAGE PROCESSING AND COMPUTER VISION

5

Face Recognition, Facial Expression Recognition, Optical Character Recognition, Automated Video Surveillance.

TOTAL: 45 PERIODS

TEXT BOOKS:

- 1 Refael C Gonzalez, Richard E Woods, Wesley, "Digital Image Processing ", 4th Edition, Pearson Education, 2019.
- 2 D Forsyth and J Ponce, "Computer Vision - A modern approach", 2nd Edition, Pearson Education, 2011

REFERENCES:

- 1 Umbaugh S E, "Digital image processing and analysis: Computer vision and image

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analysis “, 4th Edition, CRC Press, 2023

- 2 Srinivasan A, “Handbook of Research on Computer Vision and Image Processing in the Deep Learning Era”, 1st Edition, IGI Global, 2023.

ONLINE RESOURCES:

- 1 https://onlinecourses.nptel.ac.in/noc19_cs58/preview
- 2 <https://www.coursera.org/learn/introduction-computer-vision-watson-opencv>
- 3 <https://archive.nptel.ac.in/courses/117/105/117105135/>

COURSE OUTCOMES:

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

- C01 Explain the fundamentals of image processing and computer vision.
- C02 Describe the concepts of Image formation and Image Enhancement.
- C03 Describe the image segmentation and feature extraction methods.
- C04 Summarize the about various Object Detection, Object Recognition, Motion estimation techniques and their applications.
- C05 Summarize the various Image processing and Computer vision algorithms to solve real time problems.

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 | - | - | - | - | 2 | 2 |
| C02 | 2 | 2 | 1 | 1 | 1 | - | - | 1 | - | - | - | - | 2 | 2 |
| C03 | 2 | 2 | 1 | 1 | 1 | 1 | - | 1 | - | - | - | - | 2 | 2 |
| C04 | 2 | 2 | 1 | 1 | 1 | 1 | - | 1 | - | - | - | - | 2 | 2 |
| C05 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | - | - | - | 1 | 2 | 2 |

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U23PECS08 **NEURAL NETWORKS AND DEEP LEARNING** **L T P C**

Pre requisites: Machine learning **2 0 2 3**

COURSE OBJECTIVES:

- To acquire knowledge of the theoretical foundations, algorithms, and methodologies of Neural Network.
- It covers various deep learning methods of convolutional neural networks.
- To understand the neural networks, and other advancements.

UNIT I **INTRODUCTION TO DEEP LEARNING** **6**

Introduction, Machine learning vs. deep learning, applications of deep learning, Feature engineering, Deep learning frameworks, Bias, Variance, Regularizations.

UNIT II **INTRODUCTION TO NEURAL NETWORKS** **6**

Review of Neural network basics – architectures, activation functions, parameters, Single layer and Multilayer Perceptron, Backpropagation learning.

UNIT III **CONVOLUTIONAL NEURAL NETWORKS (CNNs)** **6**

Introduction to CNNs – convolution, pooling, Deep CNNs, Different deep CNN architectures – LeNet, AlexNet, VGG, InceptionV3, etc., Training a CNNs: weights initialization, batch normalization, hyperparameter optimization, Understanding and visualizing CNNs, Transfer learning, CNN applications

UNIT IV **RECURRENT NEURAL NETWORKS (RNNs)** **6**

Introduction to RNN, Sequence modeling using RNNs, Long Short-Term Memory (LSTM), Bidirectional LSTMs, Bidirectional RNNs, Gated Recurrent Units, Autoencoders

UNIT V **GENERATIVE MODELS** **6**

Restrictive Boltzmann Machines (RBMs), Belief nets, Deep belief nets, Generative Adversarial Networks (GAN), Applications of Generative models.

30 PERIODS

PRACTICAL EXERCISES:

1. Implementation of multi-layer network and study network parameters for any application.
2. Implement Digit Recognition for MNIST dataset using pretrained models.
3. Implement CNN architecture for any given classification task.
4. Perform object recognition using CNN Model.

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5. Implement LSTM model and test it for a given application/dataset.
6. Implement GRU model and test it for a given application/dataset

30 PERIODS
TOTAL: 60 PERIODS

TEXT BOOKS:

- 1 Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", 1st Edition, MIT Press, 2017.
- 2 Josh Patterson, Adam Gibson "Deep Learning: A Practitioner's Approach", 1st Edition, O'Reilly Media, 2017.

REFERENCES:

- 1 Umberto Michelucci "Applied Deep Learning. A Case-based Approach to Understanding Deep Neural Networks", 1st Edition, A press, 2018.
- 2 Aurelion Geron, "Hands-on machine learning with Scikit-learn Keras and TensorFlow", 3rd Edition, O'Reilley Media, 2022
- 3 Francois Chollet, "Deep Learning with Python", 2nd Edition, Manning Publication, 2021.

ONLINE RESOURCES:

- 1 <https://nptel.ac.in/courses/106/106/106106184>
- 2 <https://www.coursera.org/learn/neural-networks-deep-learning>

COURSE OUTCOMES:

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

- CO1** Summarize the characteristics of deep learning models.
- CO2** Explain the idea of artificial neural networks and their architecture.
- CO3** Apply the various Convolutional Neural Networks (CNNs) algorithms.
- CO4** Apply the Recurrent Neural Networks (RNNs) algorithms.
- CO5** Explain the generative models of deep learning.

CO - PO - PSO MAPPING:

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

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U23PECS09

AI FOR CYBERSECURITY

L T P C

Pre requisites: Familiarity with Probability, Machine Learning

3 0 0 3

COURSE OBJECTIVES:

- To understand ML models to classify malwares.
- To learn the simple intrusion detection systems using deep neural networks.
- To acquire knowledge the vulnerabilities in ML systems and state methods to address adversarial attacks.

UNIT I BASICS OF MACHINE LEARNING IN CYBERSECURITY 9

Overview on Machine Learning with use cases from cybersecurity, classification of threats, attacks, vulnerabilities, malware, trojans etc. Why Machine Learning and Security, Real-World Uses of Machine Learning in Security, Classifying and Clustering, Supervised Classification Algorithms

UNIT II MALWARE CLASSIFICATION 9

Malware Analysis, Feature Generation, From Features to Classification, Identifying Attack Campaigns Using Malware Networks, Understanding Machine Learning-Based Malware Detectors

UNIT III ANOMALY DETECTION 9

Anomaly Detection, Anomaly Detection Versus Supervised Learning, Intrusion Detection with Heuristics, Data-Driven Methods, Feature Engineering for Anomaly Detection, Anomaly Detection with Data and Algorithms, Challenges of Using Machine Learning in Anomaly Detection, Time Series Analysis and Ensemble Modeling, Classes of time series models, Time series analysis in cybersecurity, Time series trends and seasonal spikes, Ensemble learning methods, Types of ensemble algorithm

UNIT IV NETWORK INTRUSION DETECTION 9

Network Traffic Analysis, Theory of Network Defense, Machine Learning and Network Security, Building a Predictive Model to Classify Network Attacks, Efficient Network Anomaly Detection Using k-means

UNIT V ADVERSARIAL ATTACKS 9

Adversarial attacks on ML systems, model poisoning, black box attacks, white box attacks, state-of-art research paper reading on deep learning systems

TOTAL: 45 PERIODS

TEXT BOOKS:

- 1 Halder S, " Hands-on machine learning for cybersecurity ", 1st Edition, Packt Publishing, 2018
- 2 Saxe J, Sanders H, "Malware data science: Attack detection and attribution", 1st Edition, William Pollock, 2018.

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REFERENCES:

- 1 Chio C, Freeman D, "Machine learning and security: Protecting systems with data and algorithms", 1st Edition, O'Reilly Media, 2018

ONLINE RESOURCES:

- 1 <https://www.coursera.org/learn/introduction-to-ai-for-cybersecurity>
- 2 <https://archive.nptel.ac.in/courses/117/105/117105135/>
- 3 <https://www.classcentral.com/course/wolfram-u-image-signal-processing-introduction-to-image-processing-293012>

COURSE OUTCOMES:

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

- CO1** Describe the core principles of Machine Learning and its role in cybersecurity
- CO2** Describe how malware is classified using supervised and unsupervised learning techniques.
- CO3** Summarize the concepts of Time Series Analysis and Ensemble Modeling for detecting deviations from normal behavior
- CO4** Explain the Efficient Network Anomaly detection
- CO5** Describe adversarial attacks on machine learning systems.

CO - PO - PSO MAPPING:

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

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U23PECS10 **AI TOOLS FOR NATURAL LANGUAGE PROCESSING** **L T P C**
Pre requisites : Artificial Intelligence **2 0 2 3**

COURSE OBJECTIVES:

- To learn processing text data using probabilistic model with n- grams and preprocessing techniques.
- To familiar Concepts of text classification, text summarization, semantic analysis drives the subject to machine translation.
- To acquire knowledge on Machine translation techniques for language translation.

UNIT I **INTRODUCTION TO NLP** **5**

What is NLP? Challenges of NLP, History of NLP, Advantages of NLP, Disadvantages of NLP, Components of NLP, Applications of NLP, how to build an NLP pipeline? Phases of NLP, NLP APIs, NLP Libraries.

UNIT II **NATURAL LANGUAGE PROCESSING MODELS AND ALGORITHM** **5**

Unigram Language Model, Bigram, Trigram, N-gram, Advanced smoothing for language modelling, Applications of Language Modeling, Natural Language Generation, Parts of Speech Tagging, Morphology, Named Entity Recognition.

UNIT III **TEXT PROCESSING ANALYSIS, SUMMARIZATION AND EXTRACTION** **10**

Continuous Bag-Of-Words, embedding representations for words Lexical Semantics, Word Sense Disambiguation, Knowledge-Based and Supervised Word Sense Disambiguation, Tokenization, Cleaning, Tokenizing, Removing Special Characters, Expanding Contractions, Removing Stop words, Correcting Words, Stemming, Lemmatization, Understanding Text structure. Text Classification, Text Summarization, Information Extraction, Named Entity Recognition, Question Answering in Multilingual Setting; NLP in Information Retrieval, Cross-Lingual IR

UNIT IV **APPLICATIONS OF NLP** **5**

Unsupervised Learning on Text Clustering by Document Similarity - Distance Metrics, Partitive Clustering, Hierarchical Clustering; Analyzing Document Similarity, Document Clustering, Speech recognition.

UNIT V **MACHINE TRANSLATION** **5**

Need of MT, Problems of Machine Translation, MT Approaches, Direct Machine Translations, Rule-Based Machine Translation, Knowledge-Based MT System, Statistical Machine Translation (SMT)

30 PERIODS

PRACTICAL EXERCISES:

1. Tokenization: Split the text sentence/paragraph/Data set and generate Tokens.
2. Implement a suitable stemming algorithm based on chosen data set
3. POS tagging part 1: Perform POS tagging annotation on input text.
4. POS tagging part 2: Analyze the result of POS Tagging.

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5. Generate N-grams of the text.
6. Convert text into TF IDF vectors.
7. Perform text classification.
8. Implement text similarity technique.

30 PERIODS
TOTAL: 60 PERIODS

TEXT BOOKS:

- 1 Daniel Jurafsky, James H, Martin, "Speech and Language Processing - An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition" 2nd Edition, Pearson Education, 2018.
- 2 Sarkar D, "Text analytics with Python", 1st Edition, A press, 2019

REFERENCES:

- 1 Kiraz G A," Computational nonlinear morphology: With emphasis on Semitic languages" 2nd Edition, Cambridge University Press, 2011
- 2 Bird S, Klein E, Loper E, " Natural language processing with Python: Analyzing text with the natural language toolkit " , 1st Edition, O'Reilly Media, 2009.

ONLINE RESOURCES:

- 1 <https://nptel.ac.in/courses/106/105/106105158/>
- 2 <https://www.kaggle.com/learn/natural-language-processing>
- 3 <https://www.udemy.com/topic/natural-language-processing>

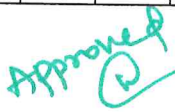
COURSE OUTCOMES:

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

- CO1** Explain the basic concepts and requirements of NLP.
- CO2** Explain the Natural Language Processing Models and Algorithm.
- CO3** Apply various NLP techniques, including word embeddings, text preprocessing and text classification
- CO4** Apply unsupervised learning techniques, including document similarity, clustering methods, and speech recognition, for text analysis.
- CO5** Explain the various approaches of Machine Translation

CO - PO - PSO MAPPING:

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


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U23PECS11

NATURE AND BIO-INSPIRED COMPUTING

L T P C

Pre requisites : Machine Learning

3 0 0 3

COURSE OBJECTIVES:

- To understand the fundamentals of nature inspired techniques which influence computing.
- To understand the Swarm Intelligence and Immuno computing techniques
- To explore the DNA Computing

UNIT I

INTRODUCTION

9

From Nature to Nature Computing, Philosophy , Three Branches: A Brief Overview, Individuals, Entities and agents - Parallelism and Distributivity Interactivity ,Adaptation-Feedback-Self-Organization-Complexity, Emergence and ,Bottom-up Vs Top-Down-Determination, Chaos and Fractals.

UNIT II

COMPUTING INSPIRED BY NATURE

9

Evolutionary Computing, Hill Climbing and Simulated Annealing, Darwin's Dangerous Idea, Genetics Principles, Standard Evolutionary Algorithm -Genetic Algorithms, Reproduction-Crossover, Mutation, Evolutionary Programming, Genetic Programming

UNIT III

SWARM INTELLIGENCE

9

Introduction - Ant Colonies, Ant Foraging Behavior, Ant Colony Optimization, SACO and scope of ACO algorithms, Ant Colony Algorithm (ACA), Swarm Robotics, Foraging for food, Social Adaptation of Knowledge, Particle Swarm Optimization (PSO)

UNIT IV

IMMUNO COMPUTING

9

Introduction- Immune System, Physiology and main components, Pattern Recognition and Binding , Immune Network Theory- Danger Theory, Evaluation Interaction- Immune Algorithms , Introduction – Genetic algorithms , Bone Marrow Models , Forest's Algorithm, Artificial Immune Networks

UNIT V

COMPUTING WITH NEW NATURAL MATERIALS

9

DNA Computing: Motivation, DNA Molecule , Adleman's experiment , Test tube programming language, Universal DNA Computers , PAM Model , Splicing Systems , Lipton's Solution to SAT Problem , Scope of DNA Computing, From Classical to DNA Computing.

TOTAL: 45 PERIODS

TEXT BOOKS:

- 1 Leandro Nunes de Castro, "Fundamentals of Natural Computing, Basic Concepts, Algorithms and Applications", 1st Edition, CRC Press, 2017.
- 2 Floreano D, Mattiussi C, "Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies", 1st Edition, MIT Press, 2008.

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REFERENCES:

- 1 Albert Y Zomaya, "Handbook of Nature-Inspired and Innovative Computing", 1st Edition, Springer, 2016.
- 2 Marco Dorigo, Thomas Stutzle, "Ant Colony Optimization", 1st Edition, Prentice Hall of India, 2015.
- 3 Srikanta Patnaik, "Nature-Inspired Computing and Optimization: Theory and Applications", 2nd Edition, Springer, 2019.

ONLINE RESOURCES:

- 1 <http://kcl.digimat.in/nptel/courses/video/109104123/L07.html>
- 2 <https://www.udemy.com/course/bio-inspired-artificial-intelligence-algorithms-for-optimization>
- 3 <https://www.aionlinecourse.com/ai-basics/bio-inspired-computing>

COURSE OUTCOMES:

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

- CO1** Describe the core principles of Nature-Inspired Computing
- CO2** Describe the Evolutionary Computing, including genetic algorithms, hill climbing, simulated annealing, and evolutionary programming.
- CO3** Explain the fundamental concepts of Swarm Intelligence
- CO4** Explain the fundamental concepts of immuno computing.
- CO5** Summarize the principles of DNA computing

CO - PO - PSO MAPPING:

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

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U23PECS12

FEATURE ENGINEERING

L T P C

Pre requisites : Mathematics and Statistics

3 0 0 3

COURSE OBJECTIVES:

- To understand the basics of feature engineering
- To learn the basics of feature representation
- To understand feature selection transformation process

UNIT I INTRODUCTION TO FEATURE ENGINEERING AND REPRESENTATION 9

Motivating example - AI-powered communications, importance of feature engineering, introduction of feature engineering, Evaluation of machine learning algorithms and feature engineering procedures, Feature understanding, Feature improvement - cleaning datasets, Feature selection - removing bad attributes, Feature construction, Feature transformation, Feature learning. Scalars, Vectors, and Spaces, Dealing with Counts, Binarization, Quantization or Binning, Log Transformation, Feature Scaling or Normalization, Min-Max Scaling, Standardization (Variance Scaling), L2 Normalization, Interaction Features, Feature Selection.

UNIT II FEATURES OF TEXT AND CATEGORICAL DATA 9

Bag-of-X: Turning Natural Text into Flat Vectors, Filtering for Cleaner Features, Atoms of Meaning: From Words to n-Grams to Phrases, Tf-Idf : A Simple Twist on Bag-of-Words, Putting It to the Test, Deep Dive, Encoding Categorical Variables, Dealing with Large Categorical Variables.

UNIT III FEATURE SELECTION 9

Importance of Feature Selection in Machine Learning, Goals of Feature Selection, Classes of Feature Selection Methodologies, Effect of Irrelevant Feature, Overfitting to Predictors and External Validation, Greedy Search Methods- Simple Filters, Recursive Feature Elimination, Stepwise Selection.

UNIT IV FEATURE TRANSFORMATIONS 9

Intuition, Derivation, Linear Projection, Variance and Empirical Variance -Vector Formulation, General Solution of the Principal Components, Transforming Features, Implementing PCA, PCA in Action, Whitening and ZCA, Considerations and Limitations of PCA, Use Cases

UNIT V FEATURE LEARNING 9

Parametric assumptions of data, Non-parametric fallacy, feature learning algorithms, Reconstructing the data, The Bernoulli RBM, Extracting PCA components from MNIST, Extracting RBM components from MNIST, Using RBMs in a machine learning pipeline, Learning text features - word vectorizations, Word embeddings, Application of word embeddings - information Retrieval.

TOTAL: 45 PERIODS

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TEXT BOOKS:

- 1 Ozdemir S, Susarla D, "Feature engineering made easy", 1st Edition, Packt Publishing, 2019
- 2 Zheng A, Casari A, "Feature engineering for machine learning: Principles and techniques for data scientists", 1st Edition, O'Reilly Media, 2018.

REFERENCES:

- 1 Kuhn M, Johnson, K, "Feature engineering and selection: A practical approach for predictive models", 1st Edition, CRC Press, 2019.
- 2 Amanda Casari, "Feature Engineering for Machine Learning: Principles and Techniques for Data Scientists", 2nd Edition, Springer, 2022.
- 3 Chip Huyen, "Designing Machine Learning Systems: An Iterative Process for Production-Ready Applications", 1st Edition, O'Reilly Media, 2019.

ONLINE RESOURCES:

- 1 <https://www.coursera.org/learn/feature-engineering>
- 2 [https://cse.nitk.ac.in/course/ Feature engineering for machine learning](https://cse.nitk.ac.in/course/Feature%20engineering%20for%20machine%20learning)
- 3 <https://www.udemy.com/course/feature-engineering>

COURSE OUTCOMES:

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

- CO1** Explain basics of feature engineering used for representing and generating process.
- CO2** Describe the features of text and categorical data.
- CO3** Summarize features of different types of data with feature selection process.
- CO4** Describe feature transformations process for converting high dimensional features to low dimensional features.
- CO5** Explain feature learning process from the given input.

CO - PO - PSO MAPPING:

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

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U23PECS13

WEB-BASED TECHNOLOGIES

L T P C

Prerequisites: Object Oriented Programming

3 0 0 3

COURSE OBJECTIVES:

- To acquire knowledge on modern interactive web pages using HTML, CSS and Scripting language and accessing databases by using JDBC and Hibernate.
- To learn client side programming using JSON, JQUERY, XML and Server Side Programming using servlets and JSP.
- To learn PHP, XML and Web Application frameworks.

UNIT I WEBSITE BASICS, HTML 5, CSS 3, WEB 2.0 9

Web Essentials: Clients, Servers and Communication – The Internet – World wide web – HTTP Request Message – HTTP Response Message – Web Clients – Web Servers– HTML 5–Tables – Lists – Image – HTML 5 control 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-Exception Handling- Validation- Built-in objects-Event Handling- DHTML with JavaScript- JSON introduction – Syntax – Function Files.

UNIT III SERVER SIDE PROGRAMMING 9

Servlets: Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions- Session Handling- Understanding Cookies- DATABASE CONNECTIVITY: JDBC. 121

UNIT IV PHP and XML 9

An introduction to PHP: PHP- Using PHP- Variables- Program control- Built-in functions- Form Validation. XML: Basic XML- Document Type Definition- XML Schema, XML Parsers and Validation.

UNIT V WEB APPLICATIONS FRAMEWORKS 9

Web Applications Frameworks and Tools – Firebase- Docker- Node JS- React- Django- UI & UX.

TOTAL: 45 PERIODS

TEXT BOOKS:

- 1 Deitel, Nieto, "Internet and World Wide Web - How to Program", 5th Edition, Prentice Hall of India, 2018.
- 2 Jeffrey C, Jackson, "Web Technologies A Computer Science Perspective", 2nd Edition, Pearson Education, 2012.

REFERENCES:

- 1 Stephen Wynkoop, John Burke, "Running a Perfect Website", 2nd Edition, John Wiley & Sons, 2019.

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- 2 Chris Bates, "Web Programming – Building Intranet Applications", 3rd Edition, John Wiley & Sons, 2018.

ONLINE RESOURCES:

- 1 https://onlinecourses.swayam2.ac.in/nou24_cs09/preview
- 2 <https://www.geeksforgeeks.org/php-introduction>
- 3 <https://www.docker.com/play-with-docker>

COURSE OUTCOMES:

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

- C01** Comprehend the basic website using HTML and Cascading Style Sheets.
- C02** Analyze dynamic web page with validation using Java Script objects
- C03** Comprehend server side programs using Servlets and JSP.
- C04** Comprehend simple web pages in PHP and to represent data in XML format.
- C05** Design interactive web applications.

CO – PO – PSO MAPPING:

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

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U23PECS14

APPLICATION BUILDING

L T P C

Prerequisites: Web-Based Technologies

3 0 0 3

COURSE OBJECTIVES:

- To Learn about web pages using PHP and MySQL and object oriented aspects of C#
- To acquire knowledge in developing applications using Node JS , MongoDB and web based application development in .NET
- To Learn about Android application development environment.

UNIT I **PHP AND MYSQL** **9**

PHP: Introduction - Variables- Program control - Built-in functions - Form Validation - Regular Expressions - File handling - Cookies - MySQL: Connection with MySql Database, performing basic database operation, setting query parameter, Executing query Join (Cross joins, Inner joins, Outer Joins, Self joins.) - Connecting Database to PHP application.

UNIT II **APPLICATION DEVELOPMENT USING NODE JS** **9**

Node JS: Introduction -Using Events, Listeners, Timers, and Callbacks - CRUD operations-API creation and testing with node - MongoDB: Introduction to NoSQL - MongoDB Compass tool -CRUD operation queries -Accessing MongoDB from Node.js Real time Project - Full Stack Application 1- Full Stack Application 2.

UNIT III **APP DEVELOPMENT WITH C#** **9**

Introduction - User Interface - UI Widgets- Internet and Services- Delegates- Lambdas - Lambda Expressions - Events - Event Publisher - Event Listener - Localization - Manipulating XML- SAX and DOM

UNIT IV **APPLICATION DEVELOPMENT USING .NET** **9**

Introduction-Programming web application with web forms-Creating Virtual Directory and Web Application - session management Techniques, web.config, Web Services, passing datasets, returning datasets from web services, handling Transaction, handling exceptions, handling exceptions from SQL Server.

UNIT V **MOBILE APP DEVELOPMENT** **9**

Introduction to Android - Android Application design essentials: terminologies, services, application context, Android Manifest files and its settings. Android user interface design essentials: UI screen elements, layouts, drawing and working with animation - Android Studio with kotlin framework - Flutter development.

TOTAL:45 PERIODS

TEXT BOOKS:

- 1 Deitel, Deitel, Nieto, "Internet and World Wide Web - How to Program", 5th Edition, Prentice Hall of India, 2018.
- 2 Herbert Schildt, "The Complete Reference: C# 4.0", Tata McGraw Hill, 2017.

REFERENCES:

- 1 Dawn Griffiths, "Head First Android Development", 3rd Edition, O'Reilly Media, 2021.

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- 2 Anthony Accomazzo, Houssein Djirdeh, Sophia Shoemaker, "Full Stack React Native: Create beautiful mobile apps with JavaScript and React Native", Full Stack publishing, 2017.

ONLINE RESOURCES:

- 1 <https://archive.nptel.ac.in/courses/106/106/106106156/>
- 2 <https://www.sap.com/resources/what-is-app-development>
- 3 <https://buildfire.com/become-mobile-app-developer/>

COURSE OUTCOMES:

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

- CO1** Comprehend server side web applications using PHP and MySQL
CO2 Describe interactive web applications using Node JS and MongoDB
CO3 Explain the C# basic concepts to solve simple problems
CO4 Explain web based application using .NET
CO5 Design an Android application using Kotlin and Flutter

CO - PO - PSO MAPPING:

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

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U23PECS15

CLOUD SYSTEM MANAGEMENT

L T P C

Prerequisites: **Cloud Computing**

2 0 2 3

COURSE OBJECTIVES:

- To learn Cloud Service Management terminology, definition, concepts & IT service management.
- To learn the strategies to reduce risk and eliminate issues associated with adoption of cloud services.
- To learn designing, deploying and running cloud-based services in a business environment.

UNIT I CLOUD SERVICE MANAGEMENT FUNDAMENTALS 6

Cloud Ecosystem - The Essential Characteristics - Basics of Information Technology Service Management and Cloud Service Management - Service Perspectives -Cloud Service Models - Cloud Service Deployment Models

UNIT II CLOUD SERVICE STRATEGY 6

Cloud Strategy Fundamentals - Cloud Strategy Management Framework - Cloud Policy - Key Driver for Adoption - Risk Management - IT Capacity and Utilization - Demand and Capacity matching - Demand Queuing - Change Management - Cloud Service Architecture

UNIT III CLOUD SERVICE MANAGEMENT 6

Cloud Service Reference Model, Cloud Service Life Cycle, Basics of Cloud Service Design, Dealing with Legacy Systems and Services, Benchmarking of Cloud Services, Cloud Service Capacity Planning, Cloud Service Deployment and Migration, Cloud Marketplace, Cloud Service Operations Management.

UNIT IV CLOUD SERVICE ECONOMICS 6

Pricing models for Cloud Services – Freemium - Pay Per Reservation - Pay per User - Subscription based Charging - Procurement of Cloud-based Services - Capex vs Opex Shift - Cloud service Charging - Cloud Cost Models

UNIT V CLOUD SERVICE GOVERNANCE & VALUE 6

IT Governance Definition - Cloud Governance Definition - Cloud Governance Framework - Cloud Governance Structure - Cloud Governance Considerations - Cloud Service Model Risk Matrix - Understanding Value of Cloud Services - Measuring the value of Cloud Services - Balanced Scorecard - Total Cost of Ownership

30 PERIODS

PRACTICAL EXERCISES

1. Create a Cloud Organization in AWS/Google Cloud/or any equivalent Open Source cloud software's like Openstack, Eucalyptus, OpenNebula with Role-based access control.
2. Create a Cost-model for a web application using various services and do Cost-benefit analysis.
3. Create alerts for usage of Cloud resources.
4. Create Billing alerts for your Cloud Organization.

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- Compare Cloud cost for a simple web application across AWS, Azure and GCP and suggest the best on.

30 PERIODS
TOTAL 60 PERIODS

TEXT BOOKS:

- Enamul Haque, "Cloud Service Management and Governance: Smart Service Management in Cloud Era", Enel Publications, 2017.
- Thomas Erl, Ricardo Puttini, Zaigham Mohammad, "Cloud Computing: Concepts, Technology & Architecture", Prentice Hall of India, 2013.

REFERENCES:

- Thomas Erl, Robert Cope, Amin Naserpour, "Cloud Computing Design Patterns", Prentice Hall of India, 2015.
- Rajkumar Buyya, Christian Vechhiola, "Mastering Cloud Computing Foundations and Applications Programming", John Wiley & Sons, 2017.

ONLINE RESOURCES:

- <https://archive.nptel.ac.in/courses/106/105/106105167/>
- <https://www.nops.io/blog/cloud-economics/>
- <https://www.geeksforgeeks.org/cloud-management-in-cloud-computing/>

COURSE OUTCOMES:

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

- CO1** Comprehend Cloud Service Management Fundamentals.
CO2 Summarize Cloud Services Strategy.
CO3 Explain Cloud Service Management.
CO4 Describe Cloud Service Economics.
CO5 Summarize Cloud Service Governance & Value.

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 | 1 | 1 | 2 | 2 |
| CO2 | 2 | 2 | 1 | 2 | 1 | - | - | 1 | - | 1 | 1 | 1 | 2 | 2 |
| CO3 | 2 | 2 | 1 | 2 | 1 | - | - | 1 | - | 1 | 1 | 1 | 2 | 2 |
| CO4 | 2 | 2 | 1 | 2 | 1 | - | - | 1 | - | 1 | 1 | 1 | 2 | 2 |
| CO5 | 2 | 2 | 1 | 2 | 1 | - | - | 1 | - | 1 | 1 | 1 | 2 | 2 |

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U23PECS16

INTERACTION DESIGN

L T P C

Prerequisites: Web-Based Technologies

3 0 0 3

COURSE OBJECTIVES:

- To learn sound knowledge and need for UI & UX.
- To understand the various Research Methods used in Design.
- To explore the various Tools used in UI & UX and Creating a wireframe and prototype.

UNIT I FOUNDATIONS OF DESIGN 6

UI vs. UX Design - Core Stages of Design Thinking - Divergent and Convergent Thinking - Brainstorming and Game storming - Observational Empathy.

UNIT II FOUNDATIONS OF UI DESIGN 6

Visual and UI Principles - UI Elements and Patterns - Interaction Behaviors and Principles - Branding - Style Guides.

UNIT III FOUNDATIONS OF UX DESIGN 6

Introduction to User Experience - Why You Should Care about User Experience - Understanding User Experience - Defining the UX Design Process and its Methodology - Research in User Experience Design - Tools and Method used for Research - User Needs and its Goals - Know about Business Goals.

UNIT IV WIREFRAMING, PROTOTYPING AND TESTING 6

Sketching Principles - Sketching Red Routes - Responsive Design - Wireframing - Creating Wireflows - Building a Prototype - Building High-Fidelity Mockups - Designing Efficiently with Tools - Interaction Patterns - Conducting Usability Tests - Other Evaluative User Research Methods - Synthesizing Test Findings - Prototype Iteration.

UNIT V RESEARCH, DESIGNING, IDEATING, & INFORMATION ARCHITECTURE 6

Identifying and Writing Problem Statements - Identifying Appropriate Research Methods - Creating Personas - Solution Ideation - Creating User Stories - Creating Scenarios - Flow Diagrams - Flow Mapping - Information Architecture

30 PERIODS

PRACTICAL EXERCISES

1. Designing a Responsive layout for a societal application.
2. Exploring various UI Interaction Patterns.
3. Developing an interface with proper UI Style Guides.
4. Developing Wireflow diagram for application using open source software.
5. Exploring various open source collaborative interface Platform.

30 PERIODS

TOTAL: 60 PERIODS

TEXT BOOKS:

- 1 Joel Marsh, "UX for Beginners", 3rd Edition, O'Reilly Media, 2022.

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- Jon Yablonski, "Laws of UX using Psychology to Design Better Product & Services", 2nd Edition, O'Reilly Media, 2021.

REFERENCES:

- Jenifer Tidwell, Charles Brewer, Aynne Valencia, "Designing Interface", 3rd Edition, O'Reilly Media, 2020.
- Steve Schoger, Adam Wathan, "Refactoring UI", 1st Edition, Rockport Publishers, 2018
- Jenny Preece, "Interaction Design: Beyond Human-Computer Interaction", 1st Edition, John Wiley & Sons, 2021.

ONLINE RESOURCES:

- <https://www.nngroup.com/articles/>
- <https://www.interaction-design.org/literature>
- <https://www.figma.com/resource-library/what-is-wireframing/>

COURSE OUTCOMES:

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

- CO1** Comprehend the UI for user Applications.
- CO2** Describe UX design of any product or application.
- CO3** Explain UX Skills in product development.
- CO4** Comprehend the Sketching principles.
- CO5** Summarize the Wireframe and Prototype.

CO - PO - PSO MAPPING:

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

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U23PECS17

QUALITY ASSURANCE AND AUTOMATION

L T P C

Prerequisites: Software Engineering

2 0 2 3

COURSE OBJECTIVES:

- To understand the basics of software testing.
- To learn how to do the testing, planning effectively, build test cases.
- To focus on wide aspects of testing, understanding multiple facets of testing and the tools used for test automation.

UNIT I FOUNDATIONS OF SOFTWARE TESTING 6

Why do we test Software?, Black-Box Testing and White-Box Testing, Software Testing Life Cycle, V-model of Software Testing, Program Correctness and Verification, Reliability versus Safety, Failures, Errors and Faults (Defects), Software Testing Principles, Program Inspections, Stages of Testing: Unit Testing, Integration Testing, System Testing.

UNIT II TEST PLANNING 6

The Goal of Test Planning, High Level Expectations, Intergroup Responsibilities, Test Phases, Test Strategy, Resource Requirements, Tester Assignments, Test Schedule, Test Cases, Metrics and Statistics.

UNIT III TEST DESIGN AND EXECUTION 6

Test Objective Identification, Test Design Factors, Requirement identification, Testable Requirements, Modeling a Test Design Process, Modeling Test Results, Boundary Value Testing, Equivalence Class Testing, Path Testing, Data Flow Testing, Model-Driven Test Design, Test Procedures, Test Case Organization and Tracking, Bug Reporting, Bug Life Cycle.

UNIT IV ADVANCED TESTING CONCEPTS 6

Performance Testing: Load Testing, Stress Testing, Volume Testing, Fail-Over Testing, Recovery Testing, Configuration Testing, Compatibility Testing, Usability Testing, Testing the Documentation, Security testing.

UNIT V TEST AUTOMATION AND TOOLS 6

Automated Software Testing, Automate Testing of Web Applications, Selenium: Introducing Web Driver and Web Elements, Locating Web Elements, Actions on Web Elements, Different Web Drivers, Understanding Web Driver Events, Testing: Understanding Testing.xml, Adding Classes, Packages, Methods to Test, Test Reports.

30 PERIODS

PRACTICAL EXERCISES

1. Develop the test plan for testing an e-commerce web application (www.amazon.in).
2. Design the test cases for testing the e-commerce application.
3. Test the e-commerce application and report the defects in it.
4. Develop the test plan and design the test cases for an inventory control system.
5. Test the performance of the e-commerce application.
6. Build a data-driven framework using Selenium and TestNG.

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7. Build Page object Model using Selenium and TestNG.

30 PERIODS
TOTAL: 60 PERIODS

TEXT BOOKS:

- 1 Yogesh Singh, "Software Testing", 2nd Edition, Cambridge University Press, 2017.
- 2 Unmesh Gundecha, Satya Avasarala, "Selenium Web Driver 3 Practical Guide", 2nd Edition, Packt Publishing, 2018.

REFERENCES:

- 1 Carl Cocchiaro, "Selenium Framework Design in Data-Driven Testing", Packt Publishing, 2018.
- 2 Paul C Jorgensen, "Software Testing: A Craftsman's Approach", 4th Edition, Taylor Francis Group, 2016.
- 3 Kshirasagar Naik, "Software Testing and Quality Assurance: Theory and Practice", 1st Edition, John Wiley & Sons, 2020.

ONLINE RESOURCES:

- 1 <https://nptel.ac.in/courses/106105150>
- 2 <https://www.softwaretestingmaterial.com/selenium-tutorial/>
- 3 <https://www.guru99.com/software-testing.html>

COURSE OUTCOMES:

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

- CO1** Comprehend the basic concepts of software testing and the need for software testing.
- CO2** Comprehend the Test planning and different activities involved in test planning.
- CO3** Summarize effective test cases that can uncover critical defects in the application.
- CO4** Describe the advanced types of Testing.
- CO5** Apply Selenium and Testing for software testing

CO - PO - PSO MAPPING:

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


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U23PECS18

WEB APPLICATION PROTECTION

L T P C

Prerequisites: **Computer Networks**

2 0 2 3

COURSE OBJECTIVES:

- To learn the fundamentals of web application security, wide aspects of secure development and deployment of web applications
- To learn the web development application tools, E-Commerce business strategy and how to build secure APIs.
- To learn basics of vulnerability assessment , penetration testing , insight about Hacking techniques and Tools

UNIT I FUNDAMENTALS OF WEB APPLICATION SECURITY 6

The history of Software Security-Recognizing Web Application Security Threats, Web Application Security, Authentication and Authorization, Secure Socket layer, Transport layer Security, Session Management.

UNIT II SECURE DEVELOPMENT 6

Web Applications Security - Security Testing, Security Incident Response Planning, The Microsoft Security Development Lifecycle (SDL), OWASP Comprehensive Lightweight Application Security Process (CLASP), The Software Assurance Maturity Model (SAMM)

UNIT III SECURE API DEVELOPMENT 6

API Security- Session Cookies, Token Based Authentication, Securing Natter APIs: Addressing threats with Security Controls, Rate Limiting for Availability, Encryption, Audit logging, Securing service-to-service APIs: API Keys , OAuth2, Securing Micro service APIs: Service Mesh, Locking Down Network Connections, Securing Incoming Requests.

UNIT IV VULNERABILITY ASSESSMENT AND PENETRATION TESTING 6

Vulnerability Assessment Lifecycle, Vulnerability Assessment Tools: Cloud-based vulnerability scanners, Host-based vulnerability scanners, Network-based vulnerability scanners, Database based vulnerability scanners, Types of Penetration Tests: External Testing, Web Application Testing, Internal Penetration Testing, SSID or Wireless Testing.

UNIT V HACKING TECHNIQUES AND TOOLS 6

Social Engineering, Injection, Cross-Site Scripting(XSS), Broken Authentication and Session Management, Cross-Site Request Forgery, Security Misconfiguration, Insecure Cryptographic Storage, Failure to Restrict URL Access, Tools: Comodo, OpenVAS, Nexpose, Nikto, Burp Suite, etc.

30 PERIODS

PRACTICAL EXERCISES:

1. Install wireshark and explore the various protocols
 - a. Analyze the difference between HTTP vs HTTPS
 - b. Analyze the various security mechanisms embedded with different protocols.
2. Identify the vulnerabilities using OWASP ZAP tool
3. Create simple REST API using python for following operation.
 - a. GET b. PUSH c. POST d. DELETE
4. Install Burp Suite to do following vulnerabilities:

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- a. SQL injection
 - b. cross-site scripting (XSS)
5. Attack the website using Social Engineering method.

30 PERIODS
TOTAL: 60 PERIODS

TEXT BOOKS:

- 1 Andrew Hoffman, "Web Application Security: Exploitation and Countermeasures for Modern Web Applications", O'Reilly Media, 1st Edition, 2020.
- 2 Neil Madden, "API Security in Action", 1st Edition, Manning Publications, 2020.

REFERENCES:

- 1 Ravi Das, Greg Johnson, "Testing and Securing Web Applications", 2nd Edition, Taylor & Francis Group, 2021.
- 2 Prabath Siriwardena, "Advanced API Security", 1st Edition, A press Media, 2020.
- 3 Andrew Hoffman, "Web Application Security: Exploitation and Countermeasures", 2nd Edition, Oreilly Media, 2018

ONLINE RESOURCES:

- 1 <https://nptel.ac.in/courses/106106129>
- 2 <https://www.lrqa.com/en/insights/articles/the-fundamentals-of-web-application-security/>
- 3 <https://www.knowledgehut.com/blog/security/ethical-hacking-techniques>

COURSE OUTCOMES:

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

- C01** Comprehend the Fundamentals of Web Application Security.
C02 Summarize Secure Development.
C03 Describe Secure API Development.
C04 Comprehend Vulnerability Assessment and Testing.
C05 Summarize Hacking Techniques and Tools.

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 | 2 |
| C02 | 2 | 2 | 1 | 1 | 1 | - | - | 1 | - | - | - | 1 | 2 | 2 |
| C03 | 2 | 2 | 1 | 1 | 1 | - | - | 1 | - | - | - | 1 | 2 | 2 |
| C04 | 2 | 2 | 1 | 1 | 1 | - | - | 1 | - | - | - | 1 | 2 | 2 |
| C05 | 2 | 2 | 1 | 1 | 1 | - | - | 1 | - | - | - | 1 | 2 | 2 |


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U23PECS19

DIGITAL TRANSMISSION

L T P C

Prerequisites: Digital Principles and Computer organization

3 0 0 3

COURSE OBJECTIVES:

- To understand the fundamental components of digital transmission system.
- To understand the working principles of digital systems
- To understand the performance of digital communication systems.

UNIT I BASIC TERMINOLOGIES AND BASE BAND TRANSMISSION 11

Principles of System Design – Analog to Digital Conversion Techniques – Modulation and Multiplexing Techniques - Baseband Transmission – Binary Coding – Power Spectral Density – Error Performance – Pulse Shaping and Inter Symbol Interference – Multilevel Baseband Transmission – Partial Response coding – Eye Patterns – Equalization – Data Scrambling Techniques.

UNIT II DIGITAL TRANSMISSION 9

Digital Modulation Techniques – ASK- FSK – BPSK – Comparison – M-ary FSK – M-ary PSK – Quadrature Amplitude Modulation – Offset QPSK – Minimum Shift Keying – Quadrature Partial Response – Digital Transmission – Telephone Networks – FDM – Transmission Parameters – Conditioning – Voice Band Modems- Wideband Modems – Trans multiplexers – Hybrid Transmission Systems.

UNIT III DIGITAL SYSTEMS 10

Digital Cable Systems – Introduction – Characteristics – Regenerative Repeaters – Clock Recovery and Jitter – Crosstalk – Error Performance – Repeater Spacing – Implementation – Digital Radio Systems – Line of Path Propagation – Multipath Fading – Frequency Allocation – Interference Effects – Digital Radio Design – Radio Link Calculation.

UNIT IV NETWORK TIMING AND SYNCHRONIZATION 8

Time Standards – Frequency Sources – Clocks – Synchronization Techniques – Dissemination Systems: Time, Frequency – Synchronization Schemes – Transmission System – Testing Techniques.

UNIT V MONITORING AND CONTROL 7

Performance Monitoring – Fault Isolation – Monitoring and Control System – Future of Digital Transmission – New Digital Services – Technology – Transmission in Local Areas – ISDN

TOTAL: 45 PERIODS

TEXT BOOKS:

- 1 David R Smith, "Digital Transmission Systems", 4th Edition, Springer, A Press, 2018.
- 2 Sam Shanmugam, "Digital and Analog Communicator Systems ", 3rd Edition, John Wiley & Sons, 2018.

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REFERENCES:

- 1 David R Smith, "Digital Transmission", 3rd Edition, Academic Press, 2020.
- 2 Jean Pierre Deschamps, Elena Valderrama, "Digital Systems", 3rd Edition, Springer, 2018.
- 3 Simon J D Prince, "Computer Vision: Models, Learning, and Inference", Cambridge University Press, 2021.

ONLINE WEB RESOURCES:

- 1 <https://archive.nptel.ac.in/courses/117/105/117105144/>
- 2 <https://freevidelectures.com/course/2278/data-communication>
- 3 <https://www.coursehero.com/file/76495279/itt459-Ch2b-Digital-Transmission>

COURSE OUTCOMES:

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

- CO1 Explain baseband transmission and signal processing principles for efficient communication system design.
- CO2 Comprehend digital modulation techniques and transmission systems for efficient communication design.
- CO3 Explain digital cable and radio systems, focusing on their characteristics, performance factors, and design principles for effective communication.
- CO4 Describe network timing, synchronization techniques, and their applications in communication systems.
- CO5 Comprehend monitoring, fault isolation, and control in digital transmission, along with emerging technologies like ISDN.

CO - PO - PSO MAPPING:

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

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U23PECS20

DATABASE SECURITY

L T P C

Prerequisites: Data Base Management Systems

2 0 2 3

COURSE OBJECTIVES:

- To analysis the risk for a large database
- To understand identification and authentication procedures and data encryption techniques
- To design and implement secure systems with a focus on operating systems, databases, and applications.

UNIT I INTRODUCTION 6

Introduction to Databases, Security Problems in Databases Security Controls Conclusions. Security Models-Introduction, Access Matrix Model, Take-Grant Model, Acten Model, PN Model, Hartson and Hsiao's Model, Fernandez's Model, Bussolati and Martella's Model for Distributed databases

UNIT II SECURITY MODELS 6

Bell and LaPadula's Model, Biba's Model, Dion's Model, Sea View Model, Jajodia and Sandhu's Model, The Lattice Model for the Flow Control conclusion. Security Mechanisms: Introduction, User Identification/Authentication, Memory Protection, Resource Protection, Control Flow Mechanisms.

UNIT III SECURITY SOFTWARE DESIGN 6

Introduction, A Methodological Approach to Security, Software Design, Secure Operating System Design, Secure DBMS Design, Security Packages, Database Security Design.

UNIT IV STATISTICAL DATABASE PROTECTION 6

Introduction, Statistics, Concepts and Definitions, Types of Attacks, Inference Controls, evaluation Criteria for Control Comparison, Introduction IDES System, RETISS System, ASES System Discovery.


UNIT V PROTECTION OF NEW GENERATION DATABASE SYSTEMS 6

Reviewing where and how database users and passwords are maintained, Obfuscate application code, Secure the database from SQL injection attacks, Beware of double whammies: Combination of SQL injection and buffer overflow vulnerability.

30 PERIODS

PRACTICAL EXERCISES:

- 1 Implementing Access Control Using the Access Matrix Model.
- 2 Design a simple simulation of information flow control using the lattice structure.
- 3 Implement a simple DBMS system with security controls.
- 4 Implement a Statistical Database Protection System in MySQL.
- 5 Design Securing Database Systems: SQL Injection, Buffer Overflow, and Access Control.

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6 Implement Advanced Security in Database Systems.

30 PERIODS
TOTAL: 60 PERIODS

TEXT BOOKS:

- 1 Hassan A Afyouni "Database Security and Auditing Protecting Data Integrity and Accessibility", 2nd Edition, Cengage, 2018.
- 2 Bhavani Thuraisingham, "Database Security: Concepts, Approaches, and Challenge", 3rd Edition, Springer, 2020

REFERENCES:

- 1 Michael Gertz, Sushil Jajodia, "Handbook of Database Security: Applications and Trends", 2nd Edition, Springer, 2017.
- 2 Thomas Connolly, Carolyn Begg," Database Systems: A Practical Approach to Design, Implementation, and Management", 7th Edition, Pearson Education, 2019.
- 3 Basta, Alfred, "Database Security: Electrical/Electronic Systems Installation and Repair",1st Edition, Delmar Publication,2016.

ONLINE WEB RESOURCES:

- 1 <https://www.udemy.com/course/database-security>
- 2 <https://archive.nptel.ac.in/courses/106/106/106106129/>
- 3 <https://study.com/academy/lesson/video/database-security>


COURSE OUTCOMES:

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

- CO1** Apply security models and controls to design and secure databases.
- CO2** Analyze security models and mechanisms to ensure confidentiality, integrity in database systems.
- CO3** Design secure software and database systems.
- CO4** Apply inference controls and protection techniques to secure statistical databases
- CO5** Apply security measures to protect databases from injection attacks and credential breaches.

CO - PO - PSO MAPPING:

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

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GOWRIYAKKAM, CHENNAI

TEXT BOOKS:

- 1 Khalid Sayood, "Introduction to Data Compression", 5th Edition, Morgan Kaufmann Publishers, 2018.
- 2 Yun-Qing Shi, "Image And Video Compression For Multimedia Engineering Fundamentals Algorithms And Standards", 3rd Edition, CRC Press, 2019.

REFERENCES:

- 1 Philip K C Tse, "Multimedia Information Storage and Retrieval: Techniques and Technologies", 1st Edition, Taxmann Publications, 2021
- 2 Irina Bocharova, "Compression for Multimedia", 1st Edition, Cambridge University Press, 2019.
- 3 Roy Hoffman, "Data Compression in Digital Systems ", 3rd Edition, Chapman and Hall, 2021.

ONLINE WEB RESOURCES:

- 1 <https://archive.nptel.ac.in/courses/117/105/117105083/>
- 2 <https://www.coursera.org/learn/video-processing>
- 3 <https://www.udemy.com/course/compression-fundamentals>

COURSE OUTCOMES:

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

- CO1** Describe the basics of text, Image and Video compression.
- CO2** Explain the various compression algorithms for multimedia content
- CO3** Design the applications of various compression techniques
- CO4** Apply disk striping, replication, and constraint allocation techniques for efficient data management.
- CO5** Describe scheduling methods for request streams

CO - PO - PSO MAPPING:

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

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U23PECS22 **TECHNOLOGICAL SYSTEMS VISUALIZATION** **L T P C**
Prerequisites: Python Programming, Foundation Data Science **2 0 2 3**

COURSE OBJECTIVES:

- To learn about different Visualization Techniques
- To understand the Interaction techniques in information visualization fields
- To understand various abstraction mechanisms

UNIT I **FOUNDATIONS FOR VISUALIZATION** **6**

Introduction to Visualization – Visualization stages – Experimental Semiotics based on Perception – Gibson’s Affordance theory – A Model of Perceptual Processing – Costs and Benefits of Visualization – Types of Data.

UNIT II **COMPUTER VISUALIZATION** **6**

Non-Computer Visualization – Computer Visualization: Exploring Complex Information Spaces – Fisheye Views – Applications – Comprehensible Fisheye views – Fisheye views for 3D data – Non Linear Magnification – Comparing Visualization of Information Spaces – Abstraction in computer Graphics – Abstraction in user interfaces.

UNIT III **MULTIDIMENSIONAL VISUALIZATION** **6**

1D, 2D, 3D – Multiple Dimensions – Trees – Web Works – Data Mapping: Document Visualization – Workspaces.

UNIT IV **TEXTUAL METHODS OF ABSTRACTION** **6**

From Graphics to Pure Text – Figure Captions in Visual Interfaces – Interactive 3D illustrations with images and text – Related work – Consistency of rendered – images and their textual labels – Architecture – Zoom techniques for illustration purpose – Interactive handling of images and text.

UNIT V **ABSTRACTION IN TIME AND INTERACTIVE SYSTEMS** **6**

Animating non Photo realistic Computer Graphics – Interaction Facilities and High Level Support for Animation Design – Zoom Navigation in User Interfaces – Interactive Medical Illustrations – Rendering Gestural Expressions – Animating design for Simulation – Tactile Maps for Blind People – Synthetic holography – Abstraction Versus Realism– Integrating Spatial and Non Spatial Data.

30 PERIODS

PRACTICAL EXERCISES:

- 1 Implementation of Data Visualization Pipeline
- 2 Exploring Complex Information Spaces in Python
- 3 Implementation of Multi-Dimensional Data and Structural Visualization
- 4 Interactive 3D Visualization with Text Labels and Zoom Functionality in Python
- 5 Interactive Animation and Visualization in Python

30 PERIODS
TOTAL: 60 PERIODS

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TEXT BOOKS:

- 1 Colin Ware, "Information Visualization Perception for Design", 3rd Edition, Morgan Kaufman Publishers, 2018.
- 2 Thomas Strothotte, "Computer Visualization–Graphics Abstraction and Interactivity", 2nd Edition, Springer, 2020.

REFERENCES:

- 1 Chaomei Chan, "Information Visualization Beyond the horizon", 2nd Edition, Springer, 2016.
- 2 Pauline Wills, "Visualisation: A Beginner's Guide", 1st Edition, Hodder and Stoughton, 2017.
- 3 Benedikt M, "Cyberspace: First Steps", 3rd Edition, Massachusetts Institute of Technology Press, 2021

ONLINE WEB RESOURCES:

- 1 <https://www.udemy.com/topic/data-visualization>
- 2 <https://www.mygreatlearning.com/academy/learn-for-free/courses/data-visualization-using-python>
- 3 <https://www.coursera.org/learn/datavisualization>

COURSE OUTCOMES:

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

- CO1** Describe the different visualization techniques.
- CO2** Explain the Interaction techniques in information visualization fields
- CO3** Apply the visualization techniques in multi-dimensional data
- CO4** Design interactive visual interfaces with textual abstraction, 3D illustrations
- CO5** Design interactive systems with animations, non-photorealistic graphics, and spatial data integration.

CO - PO - PSO MAPPING:

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

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U23PECS23

COMPUTER IMAGINATIVES

L T P C

Prerequisites: Machine Learning Techniques

3 0 0 3

COURSE OBJECTIVES:

- To understand image processing techniques for computer vision.
- To understand three-dimensional image analysis techniques.
- To understand some applications of computer vision algorithms.

UNIT I IMAGE PROCESSING FOUNDATIONS 9

Review of image processing techniques – classical filtering operations – thresholding techniques – edge detection techniques – corner and interest point detection – mathematical morphology – texture.

UNIT II SHAPES AND REGIONS 9

Binary shape analysis – connectedness – object labelling and counting – size filtering – distance functions – skeletons and thinning – deformable shape analysis – boundary tracking procedures – active contours – shape models and shape recognition – centroidal profiles – handling occlusion – boundary length measures – boundary descriptors – chain codes – Fourier descriptors – region descriptors – moments.

UNIT III HOUGH TRANSFORM 9

Line detection – Hough Transform (HT) for line detection – foot-of-normal method – line Localization – line fitting – RANSAC for straight line detection – HT based circular object detection – accurate center location – speed problem – ellipse detection – Case study: Human Iris location – hole detection – generalized Hough Transform (GHT) – spatial matched filtering – GHT for ellipse detection – object location – GHT for feature collation.

UNIT IV 3D VISION AND MOTION 9

Methods for 3D vision – projection schemes – shape from shading – photometric stereo – shape from texture – shape from focus – active range finding – surface representations – point-based representation – volumetric representations – 3D object recognition – 3D reconstruction – introduction to motion – triangulation – bundle adjustment – translational alignment – parametric motion – spline-based motion – optical flow – layered motion.

UNIT V APPLICATIONS 9

Application: Photo album – Face detection – Face recognition – Eigen faces – Active appearance and 3D shape models of faces Application: Surveillance – foreground-background separation – particle filters – Chamfer matching, tracking, and occlusion – combining views from multiple cameras – human gait analysis Application: In-vehicle vision system: locating roadway – road markings – identifying road signs – locating pedestrians.

TOTAL:45 PERIODS

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TEXT BOOKS:

- 1 R Szeliski, "Computer Vision: Algorithms and Applications", 1st Edition, Springer 2018.
- 2 Manas Kamal Bhuyan, "Computer Vision and Image Processing", 3rd edition, CRC Press, 2020.

REFERENCES:

- 1 Mark Nixon, Alberto S Aquado, "Feature Extraction & Image Processing for Computer Vision", 3rd Edition, Academic Press, 2019
- 2 E R Davies, "Computer & Machine Vision", 4th Edition, Academic Press, 2017.
- 3 Simon J D Prince, "Computer Vision: Models, Learning, and Inference", 3rd Edition, Cambridge University Press, 2018

ONLINE WEB RESOURCES:

- 1 <https://archive.nptel.ac.in/courses/106/105/106105216>
- 2 <https://www.coursera.org/learn/computer-vision-basics>
- 3 <https://www.mygreatlearning.com/academy/learn-for-free/courses/computer-vision-essentials>

COURSE OUTCOMES:

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

- CO1 Describe the image processing techniques computer vision.
- CO2 Explain the Interaction techniques in information visualization fields
- CO3 Apply Hough Transform techniques to detect and localize geometric shapes in object detection.
- CO4 Apply 3D vision and motion techniques for object recognition and scene reconstruction.
- CO5 Apply vision techniques for face recognition, surveillance, and in-vehicle systems.

CO - PO - PSO MAPPING:

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

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U23PECS24

VIDEO CREATION AND EDITING

L T P C

Prerequisites: Computer Graphics

3 0 0 3

COURSE OBJECTIVES:

- To understand the broad perspective of linear and nonlinear editing concepts
- To understand the concept of Storytelling styles
- To understand the concepts of AVID XPRESS DV4

UNIT I FUNDAMENTALS 9

Evolution of filmmaking - linear editing - non-linear digital video - Economy of Expression - risks associated with altering reality through editing.

UNIT II STORY TELLING 9

Storytelling styles in a digital world through jump cuts, L-cuts, match cuts, cutaways, dissolves, split edits - Consumer and pro NLE systems - digitizing images - managing resolutions - mechanics of digital editing - pointer files - media management.

UNIT III USING AUDIO AND VIDEO 9

Capturing digital and analog video importing audio putting video on exporting digital video to tape recording to CDs and VCDs.

UNIT IV WORKING WITH FINAL CUT PRO 9

Working with clips and the Viewer - working with sequences, the Timeline, and the canvas - Basic Editing - Adding and Editing Testing Effects - Advanced Editing and Training Techniques - Working with Audio - Using Media Tools - Viewing and Setting Preferences.

UNIT V WORKING WITH AVID XPRESS DV 4 9

Starting Projects and Working with Project Window - Using Basic Tools and Logging - Preparing to Record and Recording - Importing Files - Organizing with Bins - Viewing and Making Footage - Using Timeline and Working in Trim Mode - Working with Audio - Output Options.

TOTAL: 45 PERIODS

TEXT BOOKS:

- 1 Aaron Goold, "The Video Editing Handbook", 1st Edition, Springer, 2017.
- 2 Rahul Kumar, Harsh Raj, "The Art of Video Editing: Adobe Premiere Pro", 1st Edition, John Wiley & Sons, 2022.

REFERENCES:

- 1 Roger Crittenden, "Film and Video Editing", 2nd Edition, Routledge Publications, 2018.
- 2 Elton Johnson, "Video Production and Editing", 2nd Edition, Pearson Education, 2022.
- 3 Robert M Goodman, Patrick McGrath, "Editing Digital Video: The Complete Creative and Technical Guide", 1st Edition, A Press, 2018.

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ONLINE WEB RESOURCES:

- 1 <https://www.udemy.com/course/video-editing-masterclass>
- 2 https://onlinecourses.swayam2.ac.in/cec21_ge17/preview
- 3 <https://www.wscubetech.com/resources/video-editing/>

COURSE OUTCOMES:

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

- CO1** Describe the strengths and limitations of Linear and Nonlinear editing.
CO2 Explain the infrastructure and significance of storytelling.
CO3 Apply suitable methods for recording to CDs and VCDs
CO4 Comprehend the core issues of advanced editing and training techniques.
CO5 Design and develop projects using AVID XPRESS DV4

CO - PO - PSO MAPPING:

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

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U23PECS25 **ENTERPRISE SERVICE ARCHITECTURE** **L T P C**
Prerequisites: Computer Networks **3 0 0 3**

COURSE OBJECTIVES:

- To understand the importance of SOA in application integration
- To explore SOA, service-orientation and service composition.
- To gain knowledge on web service modeling process

UNIT I **ESA BASICS** **9**

An Overview of SOA & Service - Orientation - Applying Service - Orientation -Principles of Service - Orientation - Characteristics of SOA -Types of SOA – SOA Design Patterns – Goals of Applying Service - Orientation-Planning for and Governing SOA - Pillars of Service - Orientation - Seven Levels of Organizational Maturity

UNIT II **SERVICE COMPOSITION** **9**

Basic Concepts - Service Models and Service Layers - Service and Service Capability Candidates - Breaking down the business problem -Functional decomposition - Service encapsulation - Agnostic Context - Non-Agnostic Context - Process Abstraction and Task Services - Building Up the Service Oriented Solution - Service Composition

UNIT III **SERVICE TECHNOLOGY** **9**

An Overview of Service Technology - Web-Based Services - SOAP-Based Web Services - Components - Service Virtualization - Cloud Computing - Semantic Web - Business Process Management - Social Network Technologies -Mobile Computing - Agent - Driven Architecture - Business Intelligence - Big Data - Service - Driven Industry Models -The Enterprise Service Model - The Virtual Enterprise Model.

UNIT IV **ANALYSIS AND MODELING WITH WEB SERVICES** **9**

Web Service Modeling Process- Decompose the Business Process- Filter Out Unsuitable Actions- Define Entity Service Candidates- Identify Process Specific Logic- Identify Service Composition Candidates- Analyze Processing Requirements- Define Utility Service Candidates- Define Micro service Candidates- Apply Service - Orientation - Case Study

UNIT V **SERVICE API AND CONTRACT DESIGN** **9**

Partial ordering - Posets - Lattices as posets - Properties of lattices - Lattices as algebraic systems - Sub lattices - Direct product and homomorphism - Some special lattices - Boolean algebra.

TOTAL: 45 PERIODS

TEXTBOOKS:

- 1 Thomas Erl, Paulo Merson, Roger Stoffers, "Enterprise-Oriented Architecture Analysis

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and design for services and Micro services”, 1st Edition, Prentice Hall Service Tech Press, 2017.

- 2 Thomas Erl, Pethuru Chelliah, Clive Gee, Jürgen Kress, Berthold Maier, Hajo Normann, Leo Shuster, Bernd Trops, Clemens Utschig, Philip Wik, Torsten Winterberg, “Next Generation SOA: A Concise Introduction to Service Technology & Service-Oriented”, 1st Edition, Pearson Education, 2014.

REFERENCES:

- 1 Alex Belotser kovskiy, Stephen Kaufman, Nikhil Sachdeva, “Building Web Services with Microsoft Azure”, 1st Edition, Packet publishing, 2015.
- 2 Olaf Zimmermann, Mark Tomlinson, Stefan Peuser, “Perspectives on Webservices: Applying SOAP, WSDL and UDDI to Real-World”, 2nd Edition, Springer, 2012.
3. Thomas Erl, SOA Principles of Service Design, 1st Edition, Prentice Hall of india. 2015.

ONLINE RESOURCES:

- 1 <https://nptel.ac.in/courses/106104182>
- 2 <https://www.javatpoint.com/service-oriented-architecture>
- 3 <https://www.geeksforgeeks.org/service-oriented-architecture/>

COURSE OUTCOMES:

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

- C01 Describe the service orientation principles and business modeling.
- C02 Analyze the underlying technology for service design.
- C03 Develop design standards for SO Abased solutions
- C04 Design web services using current technologies.
- C05 Apply SOA concepts to real world problem

CO - PO - PSO MAPPING:

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

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U23PECS26

SOFT COMPUTING TECHNIQUES

L T P C

Prerequisites: Programming skills in C, or Java.

3 0 0 3

COURSE OBJECTIVES:

- To learn the basic concepts of Soft Computing
- To become familiar with various techniques like neural networks, genetic algorithms and fuzzy systems
- To apply soft computing techniques to solve problems.

UNIT I

INTRODUCTION TO SOFT COMPUTING

9

Introduction-Artificial Intelligence-Artificial Neural Networks-Fuzzy Systems Genetic Algorithm and Evolutionary Programming-Swarm Intelligent Systems Classification of ANNs-McCulloch and Pitts Neuron Model-Learning Rules: Hebbian and Delta- Perceptron Network-Adaline Network-Madaline Network.

UNIT II

ARTIFICIAL NEURAL NETWORKS

9

Back propagation Neural Networks - Kohonen Neural Network -Learning Vector Quantization -Hamming Neural Network - Hopfield Neural Network- Bidirectional Associative Memory -Adaptive Resonance Theory Neural Networks- Support Vector Machines - Spike Neuron Models.

UNIT III

FUZZY SYSTEMS

9

Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets - Classical Relations and Fuzzy Relations -Membership Functions -Defuzzification - Fuzzy Arithmetic and Fuzzy Measures - Fuzzy Rule Base and Approximate Reasoning - Introduction to Fuzzy Decision Making.

UNIT IV

GENETIC ALGORITHMS

9

Basic Concepts- Working Principles -Encoding- Fitness Function - Reproduction - Inheritance Operators - Cross Over - Inversion and Deletion Mutation Operator - Bit-wise Operators - Convergence of Genetic Algorithm.

UNIT V

HYBRID SYSTEMS

9

Hybrid Systems -Neural Networks, Fuzzy Logic and Genetic -GA Based Weight Determination - LR-Type Fuzzy Numbers - Fuzzy Neuron - Fuzzy BP Architecture - Learning in Fuzzy BP- Inference by Fuzzy BP - Fuzzy ArtMap: A Brief Introduction - Soft Computing Tools - GA in Fuzzy Logic Controller Design - Fuzzy Logic Controller

TOTAL: 45 PERIODS

TEXT BOOKS:

- 1 N P Padhy, S P Simon, "Soft Computing with MATLAB Programming", Oxford University Press, 2015.
- 2 S N Sivanandam, S N Deepa, "Principles of Soft Computing", 2nd Edition, John Wiley & Sons, 2011.

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REFERENCES:

- 1 S Rajasekaran, G A Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm, Synthesis and Applications ", 1st Edition, Prentice Hall of India, 2017.
- 2 Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, "Neuro-Fuzzy and Soft Computing", 1st Edition, Prentice Hall of India, 2021.
- 3 Kwang H Lee, First course on Fuzzy Theory and Applications, 1st Edition, Springer, 2021.

ONLINE RESOURCES:

- 1 <https://nptel.ac.in/courses/106105173>
- 2 https://onlinecourses.nptel.ac.in/noc22_cs54/
- 3 <https://www.javatpoint.com/what-is-soft-computing>

COURSE OUTCOMES:

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

- C01 Apply suitable soft computing techniques for various applications
- C02 Summarize various soft computing techniques for complex problems
- C03 Analyze various genetic and hybrid systems
- C04 Compare different Fuzzy and Neural algorithms.
- C05 Analyze the design various Neuron model systems.

CO - PO - PSO MAPPING:

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

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U23PECS27

GREEN COMPUTING

L T P C

Prerequisites: Cloud computing

3 0 0 3

COURSE OBJECTIVES:

- To acquire knowledge to adopt green computing practices to minimize negative impacts on the environment.
- To examine the power management in computing devices.
- To understand how to minimize equipment disposal requirements

UNIT I

INTRODUCTION

9

Reputation as Motivation-Avoiding Green Wash-Green Recruiting and Retention-Money saving efforts-Implementing Energy Efficiency-Current Devices -Digitizing NON-IT Functions.

UNIT II

GREEN COMPUTING ENVIRONMENT

9

Environmental Drivers-Green Agenda-Roots of Environmentalism and IT-Imperative of Climate Change-Go Green-A New vision of Computing-Efficiency and cloud Computing-Green ability responsibility-usability-the Zen of green computing

UNIT III

GREEN DEVICES

9

Device purchases-Dimension of Device pyramid greenness-green computing-Embodied Energy-Device Green-Supplier Green-Buying principles-Desktop computers-Laptops.

UNIT IV

GREEN DATACENTERS

9

Socio-Cultural aspects of Green IT-Green Enterprise Transformation RoadMap-Green Compliance: Protocols, Standards and Audits-Emergent Carbon Issues: Technologies and Future

UNIT V

CASE STUDIES

9

The Environmentally Responsible Business Strategies (ERBS)-Case Studies-Applying Green IT Strategies and Applications to a Home, Hospital, Packaging Industry and Telecom Sector

TOTAL: 45 PERIODS

TEXT BOOKS:

- 1 Bud E Smith, "Green Computing: Tools and Techniques for Saving Energy, Money, and Resources", 1st Edition, CRC Press, 2014
2. Wu Chun Fang, "Green Computing Book", 1st Edition, CRC Press, 2014.

REFERENCES:

- 1 Alin Gales, Michael Schaefer, Mike Ebbers, "Green Data Center: steps for the Journey, Shroff", 1st Edition, IBM Redbooks, 2011.

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- 2 Carl speshocky, "Empowering Green Initiatives with IT", 1st Edition, John Wiley & Sons, 2010.

ONLINE RESOURCES:

- 1 <https://nptel.ac.in/courses/110104119>
- 2 <https://www.geeksforgeeks.org/future-of-green-computing>
- 3 <https://www.javatpoint.com/green-computing>

COURSE OUTCOMES:

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

- CO1** Describe the resources pertaining to greenhouse gases and warming.
CO2 Develop energy efficient computing applications
CO3 Analyze the consumption of power in data centers.
CO4 Evaluate deep green computing use in relation to environmental perspectives.
CO5 Discuss how the choice of hardware and software can facilitate more sustainable operation

CO - PO - PSO MAPPING:

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

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U23PECS28

CLOUD SERVICE MANAGEMENT

L T P C

Prerequisites: Cloud Computing

3 0 0 3

COURSE OBJECTIVES:

- To understand the various distributed system models and evolving computing paradigms
- To realize the reasons for migrating into cloud
- To describe the security aspects in cloud and the services offered by a cloud.

UNIT I CLOUD COMPUTING FUNDAMENTALS 9

Definition of Cloud computing, Roots of Cloud Computing, Layers and Types of Clouds, Desired Features of a Cloud, Cloud Infrastructure Management, Infrastructure as a Service Providers, Platform as a Service Providers. Computing Paradigms: High-Performance Computing, Parallel Computing, Distributed Computing, Cluster Computing, Grid Computing

UNIT II MIRATING IN TO A CLOUD 9

Introduction, Broad Approaches to Migrating into the Cloud, the Seven-Step Model of Migration into a Cloud, Enriching the 'Integration as a Service' Paradigm for the Cloud Era, the Onset of Knowledge Era and the Evolution of SaaS,

UNIT III INFRASTRUCTURE AS A SERVICE (IAAS) & PLATFORM (PAAS) 9

Virtual machines provisioning and Migration services, Virtual Machines Provisioning and Manageability, Virtual Machine Migration Services, VM Provisioning and Migration in Action. On the Management of Virtual machines for Cloud Infrastructures- Aneka—Integration of Private and Public Clouds.

UNIT IV SOFTWARE AS A SERVICE(SAAS) & DATA SECURITY 9

Software as a Service SAAS), Google App Engine – Centralizing Email Communications- Collaborating via Web Based Communication Tools-An Introduction to the idea of Data Security.

UNIT V CREATING AND EVALUATING VISUAL REPRESENTATION 9

SLA Management in cloud computing: Traditional Approaches to SLO Management, Types of SLA, Life Cycle of SLA, SLA Management in Cloud.

TOTAL: 45 PERIODS

TEXT BOOKS:

- 1 Rajkumar Buyya, James Broberg, " Cloud Computing Principles and Paradigms", 2nd Edition, John Wiley & Sons, 2015
- 2 C Anthony, T Velte, Toby J Velte, Robert Elsenpeter, "Cloud Computing: A Practical Approach", 2nd Edition, Tata McGraw Hill, 2011.

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- 1 John W Rittinghouse, James F Ransome, "Cloud Computing: Implementation, Management and Security", 2nd Edition, CRC Press, 2012.
- 2 Tim Mather, Subra Kumaraswamy, Shahed Latif, "Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance ", 1st Edition, O'Reilly Media, 2011
- 3 K. Chandrasekhran, "Essentials of cloud Computing", 1st Edition, CRC press, 2014

ONLINE RESOURCES:

- 1 <https://nptel.ac.in/courses/106105223>
- 2 <https://www.geeksforgeeks.org/cloud-management-in-cloud-computing>
- 3 <https://www.coursera.org/browse/information-technology/cloud-computing>

COURSE OUTCOMES:

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

- CO1** Describe and understand various service delivery models of a cloud computing
CO2 Summarize the ways in which the cloud can be programmed and deployed.
CO3 Analyze the comparative advantages and disadvantages of Virtualization technology
CO4 Analyze authentication, confidentiality and privacy issues in cloud computing
CO5 Describe security implications in cloud computing

CO - PO - PSO MAPPING:

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

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U23PECS29

PARALLEL COMPUTING

L T P C

Prerequisites: Computer Networks

3 0 0 3

COURSE OBJECTIVES:

- To learn the fundamentals of high-performance computer architecture
- To gain knowledge of pipelining and super scalar techniques
- To acquire understanding of High-Performance Computing Paradigms.

UNIT I

INTRODUCTION

9

High-Performance Computer - Computing - The Modern Computer Performance Improvements - RISC processors - CISC - RISC Vs CISC - Levels of Parallelism - Models - Architectures: N-wide Superscalar Architectures - Multi-core - multi-threaded.

UNIT II

PROCESSOR AND MEMORY HIERARCHY

9

Advanced Processor Technology - Superscalar & Vector Processors - Memory Hierarchy Technology - Virtual Memory Technology - Bus Systems - Cache Memory Organizations - Shared Memory Organizations.

UNIT III

PIPELINING AND SUPERSCALAR TECHNIQUES

9

Linear Pipeline Processors - Nonlinear Pipeline Processors - Pipeline Design - Arithmetic Pipeline Design.

UNIT IV

PARALLEL AND SCALABLE ARCHITECTURE

9

Multiprocessor System Interconnects - Cache Coherence and Synchronization Mechanisms - Three Generations of Multicomputer - Message passing Mechanisms - Vector Processing Principles - Multivector Multiprocessors - Compound Vector Processing.

UNIT V

HIGH-PERFORMANCE COMPUTING

9

High-Performance Computing Metrics - Paradigms: Super Computing - Cluster Computing - Grid Computing - Cloud Computing - Many-core Computing - Petascale Systems.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Jawad Haj-Yahya, Avi Mendelson, Yosi Ben Asher, Anupam Chattopadhyay, "Energy Efficient High-Performance Processors", 2nd Edition, Springer, 2018.
2. Zbigniew J Czech, "Introduction to parallel computing", 2nd Edition, Cambridge University Press, 2016.

REFERENCES:

1. Kai Hwang, Naresh Jotwani, "Advanced Computer Architecture", 2nd Edition, Tata McCraw Hill, 2011.
2. Ramesh Goankar, "Microprocessor Architecture, Programming and Applications with

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- 8085", 6th Edition, Penram International Publishing, 2013.
- 3 Grama, "Introduction to Parallel Computing: Design and Analysis of Algorithms", 2nd Edition, Addison-Wesley, 2015

ONLINE RESOURCES:

- 1 <https://nptel.ac.in/courses/106102114>
- 2 <https://www.geeksforgeeks.org/introduction-to-parallel-computing>
- 3 <https://www.ibm.com/think/topics/parallel-computing>

COURSE OUTCOMES:

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

- C01** Demonstrate the working principles of high-performance computer architecture
C02 Explain the various processor technology and memory hierarchy.
C03 Describe the pipelining and superscalar techniques.
C04 Apply the working principle of parallel and scalable architectures.
C05 Apply high-performance computing techniques.

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 | 2 |
| C02 | 2 | 2 | 1 | 2 | 1 | - | - | - | - | - | - | - | 2 | 1 |
| C03 | 2 | 2 | 1 | 2 | 1 | - | - | - | - | - | - | - | 2 | - |
| C04 | 3 | 3 | 2 | 2 | 1 | - | - | - | - | - | - | - | 2 | 1 |
| C05 | 3 | 2 | 1 | 2 | 3 | - | - | - | - | - | - | - | - | 3 |

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Applications”, 1st Edition, Elsevier, 2013.

- 3 Stanley Wasserman, John P Scott, “Social Network Analysis: A Handbook “, 2nd Edition, CRC Press, 2015

ONLINE RESOURCES:

- 1 <https://nptel.ac.in/courses/106106146>
- 2 <https://www.geeksforgeeks.org/types-of-social-networks-analysis/>
- 3 <https://www.coursera.org/learn/social-network-analysis>

COURSE OUTCOMES:

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

- C01** Describe functions of various social media networking sites
- C02** Explain the use of social media applications in the public sectors
- C03** Summarize knowledge on risk of social media and mitigate the risks
- C04** Analyze dark side of social media and to take preventive measures
- C05** Write the policies and privacy framework of social network

CO – PO – PSO MAPPING:

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

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U23PECS31

ARTIFICIAL INTELLIGENCE FOR ROBOTICS

L T P C

Pre requisites : Artificial Intelligence

2 0 2 3

COURSE OBJECTIVES:

- To know the fundamental knowledge on the concepts and techniques of robot manipulator, its kinematics.
- To familiarizes the students on various Programming and Machine Vision application in robots.
- To builds confidence among students to evaluate, choose and incorporate robots in engineering systems.

UNIT I

FUNDAMENTALS OF ROBOT

6

Robot – Definition – Robot Anatomy – Co-ordinate systems, Work Envelope, types and classification – specifications – Pitch, yaw, Roll, Joint Notations, Speed of Motion, Pay Load – Robot Parts and their functions – Need for Robots – Different Applications

UNITII

ROBOT KINEMATICS

6

Forward kinematics, inverse kinematics and the difference: forward kinematics and inverse Kinematics of Manipulators with two, three degrees of freedom (in 2 dimensional), four degrees of freedom (in 3 dimensional) – derivations and problems. Homogeneous transformation matrices, translation and rotation matrices

UNITIII

ROBOT DRIVE SYSTEMS AND END EFFECTORS

6

Pneumatic Drives – Hydraulic Drives – Mechanical Drives – Electrical Drives – D.C. Servo Motors, Stepper Motor, A.C. Servo Motors – Salient Features, Applications and Comparison of All These Drives. End Effectors – Grippers – Mechanical Grippers, Pneumatic and Hydraulic Grippers, Magnetic grippers, vacuum grippers, internal grippers and external grippers, selection and design considerations of a gripper.

UNIT IV

SENSORS IN ROBOTICS

6

Force sensors, touch and tactile sensors, proximity sensors, non-contact sensors, safety considerations in robotic cell, proximity sensors, fail safe hazard sensor systems, and compliance mechanism. Machine vision system - camera, frame grabber, sensing and digitizing image data – signal conversion, image storage, lighting techniques, image processing and analysis – data reduction, segmentation, feature extraction, object recognition, other algorithms, applications – Inspection, identification, visual serving and navigation.

UNIT V

PROGRAMMING AND APPLICATIONS OF ROBOT

6

Teach pendant programming, lead through programming, robot programming languages – VAL programming – Motion Commands, Sensors commands, End-Effector Commands, and simple programs - Role of robots in inspection, assembly, material handling, underwater, space and medical fields.

30 PERIODS

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PRACTICAL EXERCISES:

- 1 Robot Programming and simulation for pick and place
- 2 Robot Programming and simulation for color identification
- 3 Robot Programming and simulation for shape identification
- 4 Robot programming. and simulation for writing practice
- 5 Estimation of accuracy, repeatability and resolution

30 PERIODS
TOTAL: 60 PERIODS

TEXT BOOKS:

- 1 Mikell P Groover , "Industrial Robotics – Technology, Programming and applications" 2nd Edition, McGraw Hill, 2017.
- 2 Ganesh S Hedge, "A textbook of Industrial Robotics", 1st Edition, Lakshmi Publications, 2016.

REFERENCES:

- 1 Fu K S Gonalz, "Robotics Control, Sensing, Vision and Intelligence", 2nd Edition, McGraw Hill, 2017.
- 2 Yoram Koren, "Robotics for Engineers", 1st Edition, McGraw Hill, 2022.
- 3 Francis X Govers, "Robotic Artificial Intelligence", 2nd Edition, CRC Press, 2024.

ONLINE RESOURCES:

- 1 <https://nptel.ac.in/courses/107106090>
- 2 https://onlinecourses.nptel.ac.in/noc19_me74/preview
- 3 <https://www.futurelearn.com/subjects/it-and-computer-science-courses/ai-and-robotics>

COURSE OUTCOMES:

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

- C01** Analyse various features of robots and the technology involved in robotics.
C02 Apply basic engineering knowledge and laws for designing robots.
C03 Apply the drive and gripper of a robot suitable for an environment.
C04 Explain the image processing and image analysis techniques for machine vision system
C05 Create a simple program for the working of a robot

CO – PO – PSO MAPPING:

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

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U23PECS32 FUNDAMENTALS OF COMPUTATIONAL INTELLIGENCE L T P C
Pre requisites : Problem Solving and Python Programming 3 0 0 3

COURSE OBJECTIVES:

- To provide a strong foundation on fundamental concepts in Computational Intelligence.
- To enable Problem - solving through various searching techniques.
- To apply Computational techniques primarily for ML and Information retrieval.

UNIT I INTRODUCTION 9

Introduction to Artificial Intelligence-Search-Heuristic Search-A* algorithm-Game Playing-Alpha-Beta Pruning-Expert systems-Inference-Rules-Forward Chaining and Backward Chaining- Genetic Algorithms.

UNIT II KNOWLEDGE REPRESENTATION AND REASONING 9

Proposition Logic - First Order Predicate Logic – 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 - Prolog Programming.

UNIT III UNCERTAINTY 9

Non monotonic reasoning-Fuzzy Logic-Fuzzy rules-fuzzy inference-Temporal Logic-Temporal Reasoning-Neural Networks- Neuro -fuzzy Inference.

UNIT IV LEARNING 9

Probability basics - Bayes Rule and its Applications - Bayesian Networks – Exact and Approximate Inference in Bayesian Networks - Hidden Markov Models - Forms of Learning - Supervised Learning - Learning Decision Trees – Regression and Classification with Linear Models - Artificial Neural Networks – Nonparametric Models - Support Vector Machines - Statistical Learning - Learning with Complete Data - Learning with Hidden Variables- The EM Algorithm – Reinforcement Learning

UNIT V INTELLIGENCE AND APPLICATIONS 9

Natural language processing-Morphological Analysis-Syntax analysis-Semantic Analysis-Ail applications – Language Models - Information Retrieval – Information Extraction - Machine Translation – Machine Learning - Symbol-Based – Machine Learning: Connectionist – Machine Learning.

TOTAL: 45 PERIODS

TEXT BOOKS:

- 1 Stuart Russell, Peter Norvig, “Artificial Intelligence: A Modern Approach”, 3rd Edition, Pearson Education, 2010.
- 2 Elaine Rich, Kevin Knight, “Artificial Intelligence”, 3rd Edition, Tata McGraw-Hill, 2019.

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REFERENCES:

- 1 Patrick H Winston "Artificial Intelligence", 3rd Edition, Pearson Education, 2018.
- 2 Dan W Patterson, "Introduction to Artificial Intelligence and Expert Systems ", 1st Edition, Tata McGraw Hill, 2016.
- 3 Mikhail Z Zgurovsky, Yuriy P Zaychenko, "The Fundamentals of Computational Intelligence: System Approach", 2nd Edition, 2018.

ONLINE RESOURCES:

- 1 <https://www.udemy.com/topic/artificial-intelligence>
- 2 <https://www.slideshare.net/slideshow/concept-of-intelligence-144860396>
- 3 https://onlinecourses.nptel.ac.in/noc22_cs56/preview

COURSE OUTCOMES:

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

- C01 Explain the goals and methods of Computational Intelligence.
- C02 Describe the design of intelligent computational techniques.
- C03 Apply the Intelligent techniques for problem solving
- C04 Analyze problem solving skills using the acquired knowledge in the areas of, reasoning, natural language understanding, computer vision.
- C05 Apply Computational Intelligence techniques for information retrieval

CO - PO - PSO MAPPING:

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

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REFERENCES:

- 1 Edward Mize, "Data Analytics: The Ultimate Beginner's Guide to Data Analytics", 2nd Edition, 2017.
- 2 Anil Maheshwari, "Data Analytics Made Accessible", 10th Edition, Pearson Education, 2019.
- 3 Fausto Pedro García Márquez, Benjamin Lev, "Advanced Business Analytics", 3rd Edition, Springer, 2018.

ONLINE RESOURCES:

- 1 <https://www.coursera.org/specializations/data-analytics-business>
- 2 <https://learn.saylor.org/course/view.php?id=741>
- 3 <https://www.udemy.com/course/business-intelligence>

COURSE OUTCOMES:

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

- C01 Analyze Business Intelligence, Analytics and Decision Support
- C02 Explain the technologies for Decision making
- C03 Apply predictive modeling techniques
- C04 Apply sentiment analysis techniques
- C05 Design the automated and expert systems.

CO - PO - PSO MAPPING:

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

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4. Write a program to implement heuristic search procedure.
5. Implementation of expert system for diagnosis of influenza.

30 PERIODS
TOTAL: 60 PERIODS

TEXT BOOKS:

- 1 Russell S, Norvig P, "Artificial Intelligence - A Modern Approach", 3rd Edition, Prentice Hall of India, 2015.
- 2 Poole D, Mack worth "Artificial Intelligence: Foundations of Computational Agents", Cambridge University, 3rd Edition, Prentice Hall of India, 2010.

REFERENCES:

- 1 Alpaydin E, "Introduction to Machine Learning", 2nd Edition, Pearson Education, 2010.
- 2 Padhy N P, "Artificial Intelligence and Intelligent Systems", Oxford University Press, 2nd Edition, Tata McGraw Hill, 2019.
- 3 Patterson, "Introduction to artificial intelligence and expert systems", 1st Edition, Pearson Education, 2017.

ONLINE RESOURCES:

- 1 <https://www.techtarget.com/searchenterpriseai/>
- 2 <https://www.geeksforgeeks.org/expert-systems/>
- 3 <http://www.digimat.in/nptel/courses/video/106105077/L25.html>

COURSE OUTCOMES:

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

- C01** Explain Artificial Intelligence (AI) methods and describe their foundations.
- C02** Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation and learning.
- C03** Explain knowledge of reasoning and knowledge representation for solving real world problems
- C04** Analyze and illustrate how search algorithms play vital role in problem solving
- C05** Describe the construction of learning and expert system.

CO - PO - PSO MAPPING:

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

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U23PECS35

ARTIFICIAL NEURAL NETWORKS

L T P C

Pre requisites : Computer Network, Python Programming

2 0 2 3

COURSE OBJECTIVES:

- To Understand the Neural Network Fundamentals
- To learn about the different types of Neural Network models.
- To design and evaluate various types of neural network models.

UNIT I

BASICS OF ARTIFICIAL NEURAL NETWORKS

6

Introduction - Artificial Neural Networks - Historical Development of Neural Networks - Biological Neural Networks - Comparison Between them and the Computer - Comparison Between Artificial and Biological Neural Network - Basic Building Blocks of Artificial Neural Networks (ANN) Terminology ,

UNITII

FUNDAMENTAL MODELS OF ARTIFICIAL NEURAL NETWORKS

6

Introduction - McCulloch - Pitts Neuron Model - Learning Rules - Hebbian Learning Rule Perceptron Learning Rule - Delta Learning Rule (Widrow-Hoff Rule or Least Mean Square (LMS) Rule - Competitive Learning Rule - Out Star Learning - Boltzmann Based Learning - Hebb Net. Perceptron Networks: Introduction - Single Layer Perceptron - Brief Introduction to Multilayer Perceptron Networks.

UNITIII

ADALINE AND MADALINE NETWORKS

6

Introduction- Adaline - Madaline . Associative Memory Networks : Introduction - Algorithms for Pattern Association - Hetero Associative Memory Neural Networks - Auto Associative Memory Network - Bi- directional Associative Memory.

UNIT IV

FEEDBACK NETWORKS

6

Introduction - Discrete Hopfiled Net - Continuous Hopfiled Net - Relation between BAM and Hopfiled Nets. Feed Forward Networks: Introduction - Back Propagation Network (BPN) - Radial Basis Function Network (RBFN).

UNIT V

SELF-ORGANIZING FEATURE MAP

6

Introduction - Methods Used for Determining the Winner - Kohonen Self Organizing Feature Maps - Learning Vector Quantization (LVQ) - Max Net - Maxican Hat, - Hamming Net.

30PERIODS

PRACTICAL EXERCISE:

1. Implement simple vector addition in Tensor Flow.
2. Implement an image classifier using CNN in Tensor Flow/Keras.
3. Implementation of Adeline network for system identification
4. Implementation of Madeline network

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- Write a program to draw a graph with multiple curve.

30PERIODS
TOTAL:60PERIODS

TEXT BOOKS:

- Sivanandam S, Sumathi S, N Deepa, "Introduction to Neural Networks", 2nd Edition, Tata McGraw Hill, 2015.
- Yegnanarayana, "Artificial Neural Networks", 1st Edition, prentice Hall of India, 2021.

REFERENCES:

- Simon Haykin, "Neural networks A comprehensive foundations", 2nd Edition, Pearson Education, 2009.
- B Yegnanarayana, "Artificial neural networks", 1st Edition, Prentice Hall of India, 2015.
- Li Min Fu, "Neural networks in Computer intelligence", 1st Edition, Tata McGraw Hill, 2010

ONLINE RESOURCES:

- <http://www.macs.hw.ac.uk/~yjc32/>
- <https://www.sci.brooklyn.cuny.edu/>
- <https://www.udemy.com/course/deeplearning/neural-network/>

COURSEOUTCOMES:

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

- CO1 Describe the difference between biological neuron and artificial neuron
- CO2 Explain the application areas of neural networks
- CO3 Describe the building blocks of Neural Networks.
- CO4 Develop neural network models
- CO5 Summarize various methods used for determining the Winner

CO - PO - PSO MAPPING:

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

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U23PECS36

ADVANCED MACHINE LEARNING TECHNIQUES

L T P C
2 0 2 3

Pre requisites :Python Programming

COURSE OBJECTIVES:

- To Understand the need of various Problem solving.
- To Study the various supervised, semi - supervised and unsupervised learning algorithms in machine learning.
- To Under the latest trends in machine learning and design appropriate machine learning algorithms for problem solving.

UNIT I

INTRODUCTION

6

Learning problems – Perspective and Issues - Concept learning- Version Spaces and Candidate Eliminations - Conductive bias – Decision Tree Learning- Representation - Algorithm - Heuristic Space Search.

UNIT II

NEURAL NETWORKS AND GENERIC ALGORITHM

6

Neural Network Representation - Problems - Perceptrons - Multilayer Network and Back propagation algorithm - Advanced topics - Generic Algorithms - Hypothesis Space Search - Generic Programming - Models of Evaluation and learning.

UNIT III

BAYESIAN AND COMPUTATIONAL LEARNING

6

Bayes' Theorem and concept learning - Maximum Likelihood & Minimum Description Length- Bayes Optimal Classifier, Gibbs Algorithm - Naive Bayes and Bayesian Networks - EM Algorithm - Learning probabilities and sample complexity - Mistake Bound Model for learning

UNIT IV

INSTANT BASED LEARNING

6

K - Nearest Neighborhood learning - Locally weighted Regression - Radial Basis Functions - Case Based Learning.

UNIT V

ADVANCED LEARNING

6

Learning rule sets: sequential covering, first-order rules -Deductive and analytical learning - Explanation-Based Learning (EBL) and FOCL algorithm- Reinforcement Learning: tasks, Q-learning-temporal difference methods

30 PERIODS

PRACTICAL EXERCISES:

1. Implement A Star (*) Search Algorithm.
2. Implement and demonstrate the FIND-S algorithm using training data from a .CSV file.
3. Implement the Candidate-Elimination algorithm using training data from a .CSV file and show all consistent hypotheses?
4. Implement a naïve Bayesian classifier using training data from a .CSV file and compute its accuracy on test data sets?

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- Build an artificial neural network by implementing the back propagation algorithm and test the same using appropriate data set.

30 PERIODS
TOTAL: 60 PERIODS

TEXT BOOKS:

- Tom M Mitchell, "Machine Learning", 1st Edition, Tata McGraw-Hill, 2013.
- Sridhar S, Vijayalakshmi M, "Machine Learning", Oxford University Press, 2021.

REFERENCES:

- Christopher Bishop, "Pattern Recognition and Machine Learning", 3rd Edition, Tata McGraw Hill, 2018.
- Ethem Alpaydin, "Introduction to Machine Learning (Adaptive Computation and Machine Learning)", 2nd Edition, A Press, 2014.
- A Ramesh Babu, D Nagarajan, "Advanced Machine Learning Techniques", 2nd Edition, Notion Press, 2018.

ONLINE RESOURCES:

- <https://www.learnatasci.com/>
- <https://www.freecodecamp.org/>
- <https://www.coursera.org/specializations/machine-learning-introduction/>

COURSE OUTCOMES:

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

- Understand the supervised, unsupervised, semi-supervised machine learning approaches.
- Analyze the decision tree algorithm and identify and overcome the problem of over fitting.
- Analyze and apply the back propagation algorithm and generic algorithms to various problems.
- Apply the Bayesian concepts to machine learning.
- Apply First order rules in reinforcement learning algorithms.

CO - PO - PSO MAPPING:

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

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U23OE101

ALGEBRA AND NUMBER THEORY

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To make the student acquire sound knowledge of groups, rings, fields and polynomials which will be then used to solve the real life problems.
- To make the students to understand the basic concepts in number theory.
- To give an integrated approach to number theory and abstract algebra, and provide a firm basis for further reading and studying in the subject

UNIT I GROUPS AND RINGS 9

Groups - Definition - Properties - Homomorphism - Isomorphism - Cyclic groups - Cosets - Lagrange's theorem. Rings: Definition - Sub rings - Integral domain - Field - Integer modulo n - Ring homomorphism.

UNIT II FINITE FIELDS AND POLYNOMIALS 9

Rings - Polynomial rings - Irreducible polynomials over finite fields - Factorization of polynomials over finite fields.

UNIT III DIVISIBILITY THEORY AND CANONICAL DECOMPOSITIONS 9

Division algorithm - Base - b representations - Number patterns - Prime and composite numbers - GCD - Euclidean algorithm - Fundamental theorem of arithmetic - LCM.

UNIT IV DIOPHANTINE EQUATIONS AND CONGRUENCES 9

Linear Diophantine equations - Congruence's - Linear Congruence's - Applications: Divisibility tests - Modular exponentiation-Chinese remainder theorem - 2 x 2 linear systems.

UNIT V CLASSICAL THEOREMS AND MULTIPLICATIVE FUNCTIONS 9

Wilson's theorem - Fermat's little theorem - Euler's theorem - Euler's Phi functions - Tau and Sigma functions.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Jordi Guardia, Nicusor Minculete, Diana Savin, Montserrat, "New Frontiers in Number Theory and Applications", 1st Edition, Birkhauser Verlag AG, 2024.
2. Richard Michael Hill, "Introduction to Number Theory", World Scientific Europe Ltd., 2018.

REFERENCES:

1. Steven Howard Weintraub, "An Introduction to Abstract Algebra", World Scientific Publishing Company, 1st Edition, 2022.
2. John Stillwell, "Algebraic Number Theory for Beginners: Following a Path from Euclid to Noether" Cambridge University Press, 2022.

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- Ian Stewart, David Tall, "Algebraic Number Theory and Fermat's Last Theorem", Taylor and Francis, 4th Edition, CRC Press, 2020.

ONLINE RESOURCES:

- <https://nptel.ac.in/courses/111106131>
- <https://nptel.ac.in/courses/111101137>
- <https://nptel.ac.in/courses/111103020>

COURSE OUTCOMES:

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

- C01** Analyze the notations and properties of algebraic structures such as groups, rings and fields.
- C02** Analyze the polynomial rings and irreducible polynomials over finite fields.
- C03** Apply the division algorithm and fundamental theorems on prime numbers.
- C04** Apply the congruence relation in number theory to solve the real life problems.
- C05** Analyze the concepts of multiplicative functions and classical theorems.

CO – PO MAPPING:

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

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U23OE102

PROBABILITY AND QUEUEING THEORY

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To understand the basic concepts of probability, one and two dimensional random variables, and to introduce some standard distributions applicable to engineering which can describe real life phenomenon.
- To understand the basic concepts of random processes which are widely used in IT fields.
- To understand the concepts and significance of advanced queueing models and apply in engineering.

UNIT I PROBABILITY AND RANDOM VARIABLES 9

Probability – Axioms of probability – Conditional probability – Baye’s theorem - Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

UNIT II TWO DIMENSIONAL RANDOM VARIABLES 9

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables.

UNIT III RANDOM PROCESSES 9

Classification – Stationary process – Markov process - Poisson process – Discrete parameter Markov chain – Chapman Kolmogorov equations – Limiting distributions.

UNIT IV QUEUEING MODELS 9

Markovian queues – Birth and death processes – Single and multiple server queueing models – Little’s formula - Queues with finite waiting rooms – Queues with impatient customers: Balking and renegeing.

UNIT V ADVANCED QUEUEING MODELS 9

Finite source models - M/G/1 queue – Pollaczek Khinchin formula - M/D/1 and M/EK/1 as special cases – Series queues – Open Jackson networks.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. S. Venkatarama Krishnan, "Probability and Random Processes", 1st Edition, John Wiley & Sons, 2022.
2. Padma Prithvirajan, "Probability and Queueing Theory", 1st Edition, LAP Lambert Academic Publishing, 2022.

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REFERENCES:

1. Athanasios Papoulis, S. Unnikrishna Pillai, "Probability, Random Variables and Stochastic Processes", 5th Edition, Tata McGraw Hill, 2021.
2. Geoffrey Grimmett, David Stirzaker, "Probability and Random Processes", 4th Edition, OUP Oxford, 2020.
3. H A Taha, "Operations Research", 10th Edition, Pearson Education, 2019.

ONLINE RESOURCES:

1. <https://nptel.ac.in/courses/111103159>
2. <https://nptel.ac.in/courses/111106150>
3. <https://nptel.ac.in/courses/111103022>

COURSE OUTCOMES:

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

- C01** Apply the concepts of probability and some standard distributions in real life problems.
- C02** Analyze the concepts of two dimensional random variables.
- C03** Apply the concept of random processes in Engineering disciplines.
- C04** Analyze the various queue models.
- C05** Apply the concepts of series queues and open Jackson networks in real life problems.

CO – PO MAPPING:

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

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U230E103

PROBABILITY AND RANDOM PROCESSES

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To provide necessary basics in probability that are relevant in applications such as random signals and linear systems in communication engineering.
- To understand the concepts of random processes which are widely used in communication networks.
- To understand the concept of correlation, spectral densities and significance of linear systems with random inputs.

UNIT I PROBABILITY AND RANDOM VARIABLES 9
Probability–Discrete and continuous random variables–Moments – Moment generating functions–Joint Distribution–Covariance and Correlation – Transformation of a random variable.

UNIT II RANDOM PROCESSES 9
Classification–Characterization – Cross correlation and Cross covariance functions – Stationary Random Processes – Markov process - Markov chain.

UNIT III SPECIAL RANDOM PROCESSES 9
Bernoulli Process – Gaussian Process – Poisson process – Random telegraph process.

UNIT IV CORRELATION AND SPECTRAL DENSITIES 9
Auto correlation functions – Cross correlation functions – Properties – Power spectral density – Cross spectral density – Properties.

UNIT V LINEAR SYSTEMS WITH RANDOM INPUTS 9
Linear time invariant system – System transfer function – Linear systems with random inputs – Auto correlation and cross correlation functions of input and output.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. S. Venkatarama Krishnan, "Probability and Random Processes", 1st Edition, John Wiley & Sons, 2022.
2. Athanasios Papoulis, S. Unnikrishna Pillai, "Probability, Random Variables and Stochastic Processes", 5th Edition, Tata Mc Graw Hill, 2021.

REFERENCES:

1. Geoffrey Grimmett, David Stirzaker, "Probability and Random Processes", 4th Edition, Oxford University Press, 2020.
2. Hossein Pishro-Nik, "Introduction to Probability, Statistics, and Random Processes", Online Edition, Kappa Research, 2023.
3. Sheldon M. Ross, "Introduction to Probability Models", 13th Edition, Academic Press, 2021.

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ONLINE RESOURCES:

1. <https://archive.nptel.ac.in/courses/117/105/117105085/>
2. <https://ocw.mit.edu/courses/18-440-probability-and-random-variables-spring-2014/>
3. <https://ocw.mit.edu/courses/res-6-012-introduction-to-probability-spring-2018/pages/part-iii-random-processes/>

COURSE OUTCOMES:

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

- C01** Apply one- and two-dimensional random variables in engineering applications.
C02 Apply the concept random processes in engineering disciplines.
C03 Apply special random process to model the occurrences of events and the time points.
C04 Analyze the concept of autocorrelation, cross correlation, power spectral density and its importance in communication Engineering.
C05 Analyze the response of random inputs to linear time invariant systems.

CO – PO MAPPING:

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

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U230E104

LINEAR ALGEBRA

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To provide the basic notions of vector spaces which will then be used to solve related problems.
- To understand the concepts of linear transformation, inner product spaces and orthogonalization.
- To utilize numerical methods to determine the eigenvalues of a matrix and execute matrix decomposition.

UNIT I VECTOR SPACES 9

Vector spaces over Real and Complex fields – Subspace – Linear space – Linear independence and dependence – Basis and dimension.

UNIT II LINEAR TRANSFORMATION 9

Linear transformation – Rank space and null space – Rank and nullity – Dimension theorem.

UNIT III MATRIX REPRESENTATION OF LINEAR TRANSFORMATION 9

Matrix representation of linear transformation – Eigenvalues and eigenvectors of linear transformation – Diagonalization.

UNIT IV INNER PRODUCT SPACES 9

Inner product and norms – Properties – Orthogonal, Orthonormal vectors – Gram Schmidt orthonormalization process – Least square approximation.

UNIT V EIGEN VALUE PROBLEMS AND MATRIX DECOMPOSITION 9

Eigen value Problems: Power method, Jacobi rotation method – Singular value decomposition – QR decomposition.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. David C Lay, Steven R Lay, Judi J McDonald, "Linear Algebra and Its Applications", 6th Edition, Pearson Education, 2021.
2. Kenneth Hoffman, Ray Kunze, "Linear Algebra", 2nd Edition Reprint, Pearson Education, 2023.

REFERENCES:

1. Gilbert Strang, "Linear Algebra and Its Applications", 5th Edition, Cengage Learning, 2020.
2. Stephen H Friedberg, Arnold J Insel, Lawrence E Spence, "Linear Algebra", 4th Edition, Pearson Education, 2020.
3. Serge Lang, "Introduction to Linear Algebra", Revised Edition 2nd, Springer, 2021.

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ONLINE RESOURCES:

1. <https://www.coursera.org/learn/introduction-to-linear-algebra>
2. <https://ocw.mit.edu/courses/18-06-linear-algebra-spring-2010/>
3. https://onlinecourses.nptel.ac.in/noc22_ma45/preview

COURSE OUTCOMES:

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

- C01** Solve system of linear equations and test the consistency.
C02 Analyze the basis and dimension of vector space.
C03 Solve linear transformation and its matrix representation.
C04 Solve orthonormal basis of inner product space and find least square approximation.
C05 Evaluate the eigenvalues of a matrix using numerical techniques and perform matrix decomposition.

CO – PO MAPPING:

| | P01 | P02 | P03 | P04 | P05 | P06 | P07 | P08 | P09 | P010 | P011 | P012 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| C01 | 3 | 2 | 1 | 1 | - | - | - | 1 | - | - | - | 1 |
| C02 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | - | 1 |
| C03 | 3 | 2 | 1 | 1 | - | - | - | 1 | - | - | - | 1 |
| C04 | 3 | 2 | 1 | 1 | - | - | - | - | - | - | - | 1 |
| C05 | 3 | 3 | 2 | 3 | - | - | - | 1 | - | - | - | 1 |

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U230E105

EVERYDAY PHYSICS

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To develop knowledge in the basic concepts of physics.
- To understand the application of Physics in everyday life.
- To know how the applications show impact in everyday life.

UNIT I

MECHANICS AND HEAT

9

Force – weight – work – energy – power – horsepower – centrifuge – washing machine – variation of boiling point with pressure – pressure cooker – cooling by expansion – refrigerator – air conditioner – Bernoulli principle – Bunsen burner, aero plane.

UNIT II

SOUND AND OPTICS

9

Sound waves – Doppler Effect – power of lens – long sight and short sight – microscope – telescope – binocular – camera.

UNIT III

ELECTRICAL AND ELECTRONIC APPLIANCES

9

Working of the tube light and fan – kilowatt hour – fuse and heating elements – microwave oven – electric heater – photoelectric effect – video camera.

UNIT IV

GEOPHYSICS AND MEDICAL PHYSICS

9

Earthquake – Richter scale – rainfall unit – lightning arrestors – cosmic showers – Coolidge tube – X – rays – ultrasound scan – CAT.

UNIT V

ENERGY SOURCES

9

Fission – energy release – principle of nuclear reactor – radiation dosimeter – hazards and protection – solar energy – photovoltaic cell.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. D Halliday, R Resnick, J Walker, "Principles of Physics", 12th Edition, John Wiley & Sons, 2023.
2. P S Hemne, C L Arora, "Physics for B.Sc. students - Optics", S. Chand Publishing, 2022.

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REFERENCES:

1. N Ravi, "The Hindu Speaks on Scientific Facts" (Vol-1)", The Hindu Group, 2024.
2. John Christopher Draper, "A Text-book of Medical Physics", Legare Street Press, 2022.
3. Jahan Singh, "Fundamentals of Nuclear Physics", Pragati Prakashan, 2021.

ONLINE RESOURCES:

1. <http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html>
2. <http://onlinecourses.nptel.ac.in/>
3. https://books.google.com/books/about/An_Introduction_to_Medical_Physics.html

COURSE OUTCOMES:

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

- C01 Describe the mechanical concepts in various appliances.
C02 Apply the elementary mechanical concepts in sound and optics.
C03 Explain the working of electrical and electronic appliances.
C04 Summarize the basic concepts in Geo Physics and nuclear physics.
C05 Apply the concepts of nuclear physics and space sciences in our daily life.

CO – PO MAPPING:

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

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U230E106

CONSUMER AWARENESS ON APPLIANCES

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To acquire knowledge of the multiple gadgets and devices.
- To understand difference between products from multiple brands.
- To learn the basics of marketing of gadgets used in daily life.

UNIT I POWER GADGETS AT HOME AND WORK 9

The electric power grid – single and three phase connection – UPS – Voltage stabilizers – lighting – energy saving devices and techniques (fluorescent, CFL, LED, solar panels – household equipment: power consumption of devices (electric fan, air conditioner, refrigerator, washing machine).

UNIT II COMMUNICATION AND ENTERTAINMENT ELECTRONICS 9

Telephone – Facsimile – Cell phone – Photocopier – Scanner – microphones – CD/DVD/Blu-ray players – portable media players – use of headphones.

UNIT III PRODUCT INFORMATION 9

Brand name and brand mark – selection of good brand – Corporate brand and product brand – product guarantee and warranty – standardization – product servicing – after sales services.

UNIT IV ONLINE RESOURCES 9

Apps, cloud based resources – e-commerce and productivity tools – access patterns – Comparing products online – choosing websites and online stores – awareness on terms and conditions.

UNIT V NETWORKING SITES AND SAFETY 9

Significance of social networking sites, browsers and cookies – email scams – knowledge on complaint procedure and disputes settlement – security issues on payment portals.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Pearson, "Principles of Marketing", 19th Edition, Dimensions, 2023.
2. Jobber and Elli, "Principles and Practices of Marketing", 9th Edition, Tata McGraw Hill, 2020.

REFERENCES:

1. Kleinert Eric, "Troubleshooting and Repairing Major Appliances", 3rd Edition, Atlantic Publishers, 2022.
2. K B Bhatia, "Electrical appliances and devices", Khanna Publishers, 2024.
3. Charlie wing, "How Your House Works - A Visual Guide to understanding and Maintaining your Home", John Wiley & Sons, 2023.

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ONLINE RESOURCES:

1. <https://www.springer.com/series/13812>
2. <https://cloud.google.com/learn/training/networking-security>
3. https://onlinecourses.nptel.ac.in/noc24_ph17/preview

COURSE OUTCOMES:

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

- C01** Describe the power gadgets and their maintenance.
C02 Explain the devices used for communication and entertainment.
C03 Explain the information about multiple brand products to make intelligent purchase decisions.
C04 Summarize the online resources and awareness about their making policies.
C05 Describe the significance of social networking sites, knowledge on complaint procedure and security issues.

CO – PO MAPPING:

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

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U230E107

BIOPHYSICS

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To apply the knowledge about the physical forces in analysing the human body.
- To identify the necessity of diagnosis and therapy for various devices.
- To appreciate the effects of acoustics and ultrasonic in human body.

UNIT I PHYSICAL FORCES EXEMPLIFIED IN MAN 9

Introduction – mechanical forces – osmotic force – electric forces – bioelectric potentials – colloids – inter molecular forces – electromagnetic forces – generalized force.

UNIT II HEAT ENERGY AND BIO - ENERGETICS 9

Heat transfer – heat loss by the human body to the ambient air – radioactive heat transfer from the human body – Stefan – Boltzmann law – counter current heat exchange applications to vasculature of the human arm – concept of entropy in biological systems – fundamentals of energy cycle.

UNIT III WAVES: SOUND AND ULTRASOUND 9

Absorption – principle mechanism of absorption of matter waves – frictional resistance and elastic reactance of bulk tissue – Weber – Fechner law – physiological effects of intense matter waves and ultrasonic therapy - applications.

UNIT IV FLUID FLOW 9

Flow of frictionless fluids: Bernoulli's law – fluid flow in constricted tube – blood flow through a blood vessel with a partial blockage – angioplasty. Flow of viscous fluids: Analogy between fluid flow and electric current flow – fluid friction.

UNIT V RADIATION 9

Isotopes as tracers – labeling with isotopes – stable and radioactive isotopes – biological effects of radiation – internal radiation hazards – radiation units – Dosimetry.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. E J Casey, "Biophysics – concepts and mechanism", Alpha Edition, 2021.
2. William C Parke, "Biophysics - A Student Guide to the Physics of the Life Science and Medicine", Springer Nature Switzerland, 2021.

REFERENCES:

1. P Narayanan, " Essentials of Biophysics " 3rd Edition, New Age International Private Limited, 2023.
2. M A Subramanian, "Biophysics Principles and Techniques", MJP Publishers, 2021.
3. Paul Davidovits, "Physics in Biology and Medicine", 5th Edition, Elsevier Science Publishing Co Inc., 2024.

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ONLINE RESOURCES:

1. https://www.fuw.edu.pl/~jantosi/booksonbiophysics/Introduction_of_Biophysics.pdf
2. <https://archive.org/details/volkenshtein-biophysics-mir>
3. <https://ia801307.us.archive.org/29/items/biophysicsconcep00case/biophysic-sconcep00case.pdf>

COURSE OUTCOMES:

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

- C01 Summarize the knowledge about the physical forces exemplified in the human body.
- C02 Explain the importance of heat transfer in human body.
- C03 Describe the principle mechanism of matter waves and applications of ultrasound.
- C04 Apply the various laws of fluid flow in the study of human body.
- C05 Summarize the concepts of acoustic and radiation therapy.

CO - PO MAPPING:

| | P01 | P02 | P03 | P04 | P05 | P06 | P07 | P08 | P09 | P010 | P011 | P012 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| C01 | 2 | 2 | 1 | 1 | - | - | - | - | - | - | - | - |
| C02 | 2 | 2 | 1 | 1 | - | - | - | - | - | - | - | - |
| C03 | 2 | 2 | 1 | 1 | - | - | - | - | - | - | - | 1 |
| C04 | 3 | 2 | 1 | 2 | - | - | - | - | - | - | - | - |
| C05 | 2 | 2 | 1 | 1 | - | - | - | - | - | - | - | - |

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U23OE108

ASTROPHYSICS

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To elucidate the nature of the myriad objects and the universe as a whole.
- To understand the structure and the formation of myriad objects.
- To inculcate the ideas of discouraging our galaxies and their formation theories.

UNIT I OPTICAL ASTRONOMY 9

Electromagnetic spectrum and astronomical sources - emission and absorption spectra
Doppler Effect - units of distances - distance measurements in astronomy stellar
distances - Apparent - Absolute, Bolometric magnitudes - Luminosity.

UNIT II STARS 9

Spectral classification of stars - H-R diagram: binary and multiple stars visual,
astrometry and eclipsing binaries - galactic and globular clusters - Stellar evolution -
birth and death of a star - Sun - typical star - Structure of photosphere - sunspots.

UNIT III MOON 9

The moon's orbit relative to the earth - moon's distance - moon's phases - sidereal and
synodic month - character of moon's surface - lunar eclipse - lunar tides - origin of
moon.

UNIT IV BETWEEN THE PLANETS 9

Asteroids - meteoroids - meteors - comets - orbits of comets - spectrum of comets -
formation of comet's tail.

UNIT V DISCOVERING OUR GALAXIES 9

The Milky Way Structural Feature Galaxies - Galaxies and universe: shape of galaxies -
distance of galaxies big bang and steady state theory - galactic rotation - cluster of
galaxies - cosmology.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. K S Krishna Swamy, "Astrophysics", New Age International Private Limited, 2022.
2. Wolfgang Demtroder, "Astrophysics", Springer, 2023.

REFERENCES:

1. Minn Carleton College, "Astronomy", Legare Street Press, 2023.
2. Camille Flammarion, "Astronomy", Legare Street Press, 2023.
3. Maggie Aderin-Pocock, "The sky at night: The art of stargazing", BBC books, 2023.

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Y6599yfrONLINE RESOURCES:

1. <https://www.uu.edu/societies/inklings/books/scienceandfaith/Chapter4.pdf>
2. <https://www.britannica.com/science/stellar-classification>
3. <https://openstax.org/books/astronomy-2e/pages/5-6-the-doppler-effect>

COURSE OUTCOMES:

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

- C01** Apply physics principles to the interpretation of a broad range of astrophysical Observations.
- C02** Explain stellar evolution, including red giants, supernovas, neutron stars, pulsars, white dwarfs and black holes, using evidence and presently accepted theories.
- C03** Summarize the basic properties of the Sun.
- C04** Describe the features of objects in the Solar System, giving details of similarities and differences between these objects.
- C05** Describe the main features of formation theories of various types of observed galaxies.

CO - PO MAPPING:

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

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| | | |
|----------|---|--------------------|
| U230E109 | INTRODUCTION TO NANOSCIENCE AND NANOTECHNOLOGY | L T P C 3 0 0 3 |
|----------|---|--------------------|

COURSE OBJECTIVES:

- To explain about nanomaterials, their importance and their dimensions.
- To study about the synthetic methods of nanomaterials.
- To develop skills about the structure, function and application of nanomaterials.

| | | |
|---------------|---------------------|----------|
| UNIT I | INTRODUCTION | 9 |
|---------------|---------------------|----------|

Nanoscale Science and Technology- Introduction, Classifications of nanostructured materials - nano particles- quantum dots, nanowires ultra-thinfilms-multi layered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties.

| | | |
|----------------|---------------------------------------|----------|
| UNIT II | GENERAL METHODS OF PREPARATION | 9 |
|----------------|---------------------------------------|----------|

Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, Sputtering, Evaporation, Molecular Beam Epitaxy, Electrochemical deposition.

| | | |
|-----------------|----------------------|----------|
| UNIT III | NANOMATERIALS | 9 |
|-----------------|----------------------|----------|

Nanometal oxides-ZnO, TiO₂, MgO, ZrO₂, NiO, nano alumina, CaO, AgTiO₂, Ferrites, Quantum wires, Quantum dots. Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- Synthesis, structure-property Relationships and applications, Nanocomposites - FRP synthesis, property and its application.

| | | |
|----------------|------------------------------------|----------|
| UNIT IV | CHARACTERIZATION TECHNIQUES | 9 |
|----------------|------------------------------------|----------|

Xray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques, AFM, SPM, STM, SNOM, ESCA, SIMS.

| | | |
|---------------|---------------------|----------|
| UNIT V | APPLICATIONS | 9 |
|---------------|---------------------|----------|

NanoInfoTech: Information storage- nanocomputer, molecular switch, super chip, nanocrystal, Nanobiotechnology: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targeted drug delivery, Bioimaging - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nanosensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sun barrier products - In Photostat, printing, solar cell, battery.

TOTAL: 45 PERIODS


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TEXT BOOKS:

1. R L Snyder, R W Kelsall, D L Jones, "Nanotechnology: A Hands-On Approach", 2nd Edition , John Wiley & Sons, 2023.
2. M C Roco, W S Bainbridge, B E Tonn, G M Whitesides, "Nanotechnology Research Directions for Societal Needs in 2025", Springer, 2024.

REFERENCES:

1. C Binns, "Introduction to Nanoscience and Nanotechnology", 2nd Edition, Wiley- Blackwell, 2021.
2. T Pradeep, "Atomically Precise Metal Nanoclusters", Elsevier, 2022.
3. C Anandharamakrishnan, "3D Printing of Foods", John Wiley & Sons, 2024.

ONLINE RESOURCES:

1. <https://www.classcentral.com/course/electronics-purdue-university-fundamentals-of-nan-40243>
2. <https://www.classcentral.com/course/swayam-chemistry-of-nanomaterials-269673>.
3. <https://www.classcentral.com/course/introduction-to-the-modern-nanotechnology-22238>.

COURSE OUTCOMES:

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

- CO1** Explain the basic concepts of Nanoscience and Nanotechnology and their impact in various fields, types of nanomaterials, dimensions and their properties.
- CO2** Summarize the various techniques involved in synthesizing nanomaterials for engineering and technology applications.
- CO3** Describe the various forms of nanomaterials with their structure- property relationship and applications.
- CO4** Explain the structure of nanomaterials using various characterization techniques.
- CO5** Analyse the application of nano materials in medical, electronic and engineering fields.

CO – PO MAPPING:

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


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U23OE110

GREEN TECHNOLOGY

L T P C

3 0 0 3

COURSE OBJECTIVES:

- To introduce the concepts of green technology through understanding the basics of eco-system and Biodiversity.
- To learn different types of environmental acts and analyse the green tax incentives, rebates, business redesign and its models.
- To extend knowledge of the importance of life cycle assessment.

UNIT I

INTRODUCTION

9

The concept of green technology – its origin and historical evolution – nature, scope, significance, and multi-disciplinary approaches – classification of green technologies (e.g., clean energy, sustainable materials, carbon capture) – developing theoretical frameworks to understand green innovation – green technology initiatives and policies in India.

UNIT II

SUSTAINABILITY AND ENVIRONMENT

9

Organizational environment - internal and external environment - Indian corporate structure and environment - how to go green - spread the concept in organization - environmental and sustainability issues.

UNIT III

ECOSYSTEM ECONOMICS

9

Approaches - ecological economics - indicators of sustainability - ecosystem services and their sustainable use; bio-diversity - Indian perspective - alternate theories - Steady-state economics – circular economy.

UNIT IV

LAWS OF GREEN TECHNOLOGY

9

Laws - Environmental reporting standards and compliance mechanisms – ISO 14001 - green finance - financial initiative by United Nations Environment Programme (UNEP). Environmental Management Systems – principles, certification process, and organizational impact – ISO 14064.

UNIT V

GREEN ECONOMICS

9

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

TOTAL: 45 PERIODS

TEXT BOOKS:

1. WIPO, “Green Technology Book: Solutions for Climate Change Mitigation”, 2nd Edition, World Intellectual Property Organization, 2023.
2. S J Arceivala, “Green Technologies”, 1st Edition, Tata McGraw Hill, 2023.

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REFERENCES:

1. P Oksen, "Green Technology Book: Solutions for Climate Change Adaptation", 1st Edition, World Intellectual Property Organization, 2022.
2. A Kumar, S Singh, 'Renewable Energy and Green Technology: Principles and Practices', Routledge, 2023.
3. M N O Sadiku, "Emerging Green Technologies" CRC Press, 2022.

ONLINE RESOURCES:

1. <https://archive.nptel.ac.in/courses/105/102/105102195/>
2. https://onlinecourses.nptel.ac.in/noc20_ce57/preview
3. <https://archive.nptel.ac.in/courses/105/107/105107176/>

COURSE OUTCOMES:

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

- C01** Summarize the concepts of green technologies in a project.
- C02** Explain the importance of environment and sustainability and their classes and issues.
- C03** Apply Eco-system concepts for sustainable.
- C04** Explain the Environmental laws and regulations for green technology.
- C05** Apply the green tax incentives and rebates and Eco-commerce models for greener economics.

CO - PO MAPPING:

| | P01 | P02 | P03 | P04 | P05 | P06 | P07 | P08 | P09 | P010 | P011 | P012 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| C01 | 2 | 2 | 1 | 1 | - | - | 2 | - | - | - | 1 | 1 |
| C02 | 2 | 2 | 1 | 1 | - | - | 2 | - | - | - | 1 | 1 |
| C03 | 3 | 2 | 1 | 2 | - | - | 2 | - | - | - | 1 | 1 |
| C04 | 2 | 2 | 1 | 1 | - | - | 2 | 1 | - | - | 1 | 1 |
| C05 | 3 | 2 | 1 | 2 | - | - | 2 | - | - | - | 1 | 1 |

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U23OE111

THE ENVIRONMENT AND SOCIETY

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To understand the complexity of environmental and social impacts of industry.
- To analyze about personal responsibilities and roles in environmental and social problems.
- To acquire new ideas for better integrating industry, environment, and equity.

UNIT I ENVIRONMENT, ECOSYSTEM AND BIODIVERSITY 9

Introduction to Environment- Ecosystem and its types- Biodiversity- Types of biodiversity. Importance of biodiversity-Loss of Biodiversity- Conservation of Biodiversity.

UNIT II ENVIRONMENT AND THE HUMAN INTERACTION 9

Types of Anthropogenic Activities-Anthropogenic Activities and Their Impacts on the Environment-Ways to Mitigate the Negative Impacts of Anthropogenic Activities on the Environment-Mitigation Measures for Anthropogenic Impacts.

UNIT III ISSUES IN ENVIRONMENTALISM 9

Significant global environmental issues such as acid rain, climate change, and resource depletion; historical developments in cultural, social and economic issues related to land, forest, and water management in a global context; interface between environment and society.

UNIT IV THREATS TO ENVIRONMENT 9

Developmental issues and related impacts such as ecological degradation; environmental pollution; development-induced displacement, resettlement, and rehabilitation: problems, concerns, and compensative mechanisms; discussion on Project Affected People (PAPs).

UNIT V ENVIRONMENT AND SUSTAINABLE DEVELOPMENT 9

Causes and effects of Depletion of Natural Resources - Impact of environmental degradation-Need for Sustainable development, Strategies for Achieving Sustainability, Sustainable Development in India, Role of Individuals and Communities.

TOTAL: 45 PERIODS

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TEXT BOOKS:

1. A Sabban, "Advances in Green Electronics Technologies in 2023", 1st Edition, IntechOpen, 2023.
2. R Dogra, "Renewable Energy and Green Technology", 1st Edition; Brillion Publishing, 2023.

REFERENCES:

1. P Robbins, L Hintz, M Moore, "Environment and Society: A Critical Introduction", 3rd Edition, Wiley- Blackwell, 2022.
2. P Frankopan, "The Earth Transformed: An Untold History. Allen Lane", Bloomsbury publisher, 2023.
3. M A Ali, M Kamraju, "Natural Resources and Society: Understanding the Complex Relationship Between Humans and the Environment" Springer Cham, 2023.

ONLINE RESOURCES:

1. http://www.who.int/topics/environmental_pollution/en/
2. <http://edugreen.teri.res.in/explore/explore.htm>
3. https://onlinecourses.swayam2.ac.in/nou20_ag12/preview


COURSE OUTCOMES:

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

- CO1** Describe the environment ecosystem, importance of biodiversity and its conservation.
- CO2** Analyze the various anthropogenic activities, its impact on environment and mitigation measures.
- CO3** Describe the various global environmental issues.
- CO4** Analyse the ecological degradation, environmental pollution issues owing to developmental activities.
- CO5** Apply the green tax incentives and rebates and Eco-commerce models for greener economics.

CO – PO MAPPING:

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

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| | | | | | |
|-----------------|--|----------|----------|----------|----------|
| U230E112 | INDUSTRIAL CORROSION AND PREVENTION | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

COURSE OBJECTIVES:

- To impart Knowledge on fundamental concepts of corrosion.
- To know the various types of corrosion.
- To create corrosion prevention plans in various industries.

UNIT I INTRODUCTION TO CORROSION 9

Introduction and importance, Forms of corrosion - uniform corrosion, pitting, crevice corrosion, inter granular corrosion, stress corrosion cracking and prevention of corrosion.

UNIT II CORROSION CONTROL IN POWER INDUSTRIES 9

Introduction, Frequent forms of corrosion, environment, case studies and prevention methodology and corrosion resistance materials.

UNIT III CORROSION CONTROL IN PETROCHEMICAL INDUSTRIES 9

Introduction, regular forms of corrosion, environment, case studies, prevention strategies - inhibitors and surface engineering - corrosion resistance materials

UNIT IV CORROSION CONTROL IN MARINE INDUSTRIES 9

Introduction, Metallurgical properties influencing corrosion. Common forms of corrosion, environment, Passivity - design of corrosion resistant alloys, case studies, and corrosion resistance materials.

UNIT V CORROSION CONTROL IN FERTILIZER INDUSTRIES 9

Introduction, frequent forms of corrosion, environment, case studies and corrosion resistance materials.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Mars G Fontana, "Corrosion Engineering", 3rd Edition, Tata McGraw Hill, 2019.
2. D B David, M Bastidas David, "Corrosion and protection of Metals", Metals, 2020.

REFERENCES:

1. Savas Kaya, Ime Bassey Obot, Demet Özkir, Goncagül Serdaroglu, Ambrish Singh, "Corrosion Science: Theoretical and Practical Applications", Apple Academic Press, 2024.

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2. E J David, Talbot D R James, Talbot, "Corrosion Science and Technology", CRC Press, 2020.
3. E I Younes, Kacimi, Savas Kaya, Rachid Tourir, "New Challenges and Industrial Applications for Corrosion Prevention and Control", IGI Global, 2020.

ONLINE RESOURCES:

1. <https://nptel.ac.in/courses/113108051>
2. https://www.corrosionclinic.com/corrosion_courses/corrosion_control_prevention_5-day.htm
3. <https://www.ampp.org/technical-research/what-is-corrosion/corrosion-reference-library>

COURSE OUTCOMES:

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

- C01** Describe the basic principles of corrosion and its types.
- C02** Explain about corrosion damage in the power, petroleum, marine, and fertilizer industries.
- C03** Analyze the corrosion prevention techniques in the industries.
- C04** Summarize theory behind the fabrication of a corrosion-resistant alloy.
- C05** Explain the causes and remedies for corrosion

CO - PO MAPPING:

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

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U23OE113

ENGLISH THROUGH MEDIA

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COURSE OBJECTIVES:

- To enhance students' ability to read & write efficiently while developing information ethically.
- To cultivate students' proficiency in developing listening, thinking, advertising & persuasive writing.
- To equip their proficiency with phonetics, accents, group discussions in real life situations as well as visual and verbal media.

| | | |
|--|--|----------|
| UNIT I | READING AND WRITING SKILLS | 9 |
| Reading for information – Skimming & Scanning; Importance of Language: Subjective & Objective Language. Writing – Use of Language to manipulate information; writing feature stories – Presentation and Structure. | | |
| UNIT II | LISTENING AND INTERVIEWING SKILLS | 9 |
| Listening to talks – conversational strategies. Interviewing Skills – Agreeing and Disagreeing – Asserting and Negotiating. | | |
| UNIT III | REPORTING SKILLS – ORAL AND WRITTEN | 9 |
| Critical Thinking: Problem Solving Skills –conversation Etiquette – Politeness Strategies. Online Writing: Netiquette – Analytical report, Brevity in advertising, persuasive writing. | | |
| UNIT IV | PRESENTATION SKILLS | 9 |
| Purpose and features of presentation – Narrating Consumer Oriented Marketing of products, Group Discussion on culture, tradition, values. | | |
| UNIT V | ANALYZING AND EVALUATING SKILLS | 9 |
| Vocabulary – Collocations & Slangs – Referencing – welcoming, conducting Programmes. Reviewing & Commenting – Expressing through visual & verbal media – Authentic conversation based on real – life situations. | | |
| TOTAL: 45 PERIODS | | |

TEXT BOOKS:

1. "English for Engineers & Technologists", 2020 Edition, Orient Blackswan Private Ltd., 2020.
2. Veena Selvam, Sujatha Priyadarshini, Deepa Mary Francis, K N Shoba , Lourdes Jovani, "English for Science & Technology", Cambridge University Press, 2021.

REFERENCES:

1. James Curran, Joanna Redden, "Understanding Media: Communication, Power and Social Chang", Pelican Publishing, 2024.
2. Soma Mahesh Kumar, "Soft Skills: Enhancing Personal and Professional Success", 1st Edition, Tata McGraw Hill, 2023.
3. Rodney H Jones, Sylvia Jaworska, "Erhan Aslan; Language and Media- A Resource Book for Students", e-book, Routledge, 2020.

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ONLINE RESOURCES:

1. <https://onlinecourses.nptel.ac.in/noc20hs32/preview>
2. <https://www.coursera.org/learn/working-with-the-media>
3. <https://www.udemy.com/course/political-candidate-media-and-public-speaking-training/>

COURSE OUTCOMES:

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

- C01** Apply reading and writing skills by exploring the language used in media.
C02 Apply listening skills to communicate effectively in their area of specialization.
C03 Apply soft skills in both oral and written communication.
C04 Apply speaking skills in a variety of mediums including live communication.
C05 Analyze different types of texts in different media like online, print, and social media.

CO - PO MAPPING:

| | P01 | P02 | P03 | P04 | P05 | P06 | P07 | P08 | P09 | P010 | P011 | P012 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| C01 | 3 | - | - | - | - | - | - | 2 | - | 2 | - | - |
| C02 | 3 | - | - | - | - | - | - | 2 | - | 2 | - | - |
| C03 | 3 | - | - | - | - | - | - | 2 | - | 2 | - | - |
| C04 | 3 | - | - | - | - | - | - | 2 | - | 2 | - | - |
| C05 | 1 | - | - | - | - | - | - | 2 | - | 2 | - | - |

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U230E114

ENGLISH FOR EMPLOYABILITY SKILLS

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COURSE OBJECTIVES:

- To introduce the students to skills necessary for getting, keeping and being successful in a profession.
- To understand the importance of communication and enhance self-confidence.
- To develop and nurture the Employability skills of the students through individual and group activities.

UNIT I COMMUNICATION SKILLS 9

Communication: An Introduction; Formal and Informal English; Description, Narration and Demonstration; Methods of Communication, Verbal Communication, Non-verbal Communication; Importance of feedbacks, Basics of Effective Communication; Writing Skills - Parts of Speech and Sentences; Soft Skills for Employers and Employees.

UNIT II RESUME WRITING 9

Resume, Curriculum vitae, how to develop an impressive resume, Different formats of resume - Chronological, Functional, Hybrid, Job application or cover letter.

UNIT III PRESENTATION SKILLS 9

Presentation Techniques - Time Management Techniques - Body language - Managerial Skills - Making Effective Presentation, Professional presentation- planning, preparing and delivering presentation.

UNIT IV GROUP DISCUSSION AND PUBLIC SPEAKING 9

Introduction to Group Discussion - Understanding Group Dynamics - Group Discussion Strategies-Activities to Improve GD Skills - Public Speaking Techniques - Public Speaking Activities.

UNIT V INTERVIEW SKILLS 9

Listening to Interviews; Types of Interviews; Preparation for the Interview - Interview Techniques and Etiquettes - Mock Interview - Online Interview Techniques.

TOTAL: 45 PERIODS

TEXT BOOKS:

- 1 Prashant Sharma, "Soft Skills: Personality Development for Life Success", 1st Edition, BPB Publications, 2022.
- 2 Rajendran, Jayanthi, Jeya Santhi V, Nagalakshmi B, "The Art of English Communication: A Practical Approach", Notionpress.com, 2025.

REFERENCES:

1. Grant, Adam. "Think Again: The Power of Knowing What You Don't Know", Penguin Random House, 2021.
2. Harrison, Ryan. "How To Talk To Anybody: 14 Speaking Techniques To Instantly Connect with Anyone", LearnWell Books, 2022.
3. Gloria J Galanes, Katherine Adams, Carrisa S Hoelscher, Stephen A Spates, "Effective Group Discussion: Theory and Practice", Tata McGraw Hill, 2023.

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ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc20_hs15/preview
2. <https://www.coursera.org/learn/verbal-communications-and-presentation-skills>
3. The Complete Guide to Resume Formats: Chronological, Functional, and Hybrid | UseResume.ai

COURSE OUTCOMES:

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

- C01** Apply Employment Skills In Their Environment
- C02** Write Resume Writing & Job Application.
- C03** Apply The Fundamental Inputs Of Communication Skills In Making Speech Delivery.
- C04** Apply Various Group Discussion Skills To Take Part In Effective Discussions In A Professional Context.
- C05** Analyze Various Interview Formats For Job Interviews.

CO - PO MAPPING:

| | P01 | P02 | P03 | P04 | P05 | P06 | P07 | P08 | P09 | P010 | P011 | P012 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| C01 | 3 | - | - | - | - | - | - | 3 | 3 | 3 | - | 1 |
| C02 | 3 | - | - | - | - | - | - | 3 | 3 | 3 | - | 1 |
| C03 | 3 | - | - | - | - | - | - | 3 | 3 | 3 | - | 1 |
| C04 | 3 | - | - | - | - | - | - | 3 | 3 | 3 | - | 1 |
| C05 | 3 | - | - | - | - | - | - | 3 | 3 | 3 | - | 1 |

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U23OE115

INVENTIONS AND APPLICATIONS

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COURSE OBJECTIVES:

- To analyse the engineering principles underlying major scientific inventions and their technological evolution.
- To apply scientific inventions in solving real-world engineering problems.
- To design innovative, sustainable, and ethical engineering solutions inspired by emerging technologies.

UNIT I FOUNDATIONS OF INVENTION AND INNOVATION 9
Definition and scope of invention vs. discovery – Drivers of scientific progress – Case studies of transformative inventions (printing press, steam engine, electricity, semiconductor devices) – Innovation models: TRIZ, disruptive innovation, and design thinking – Intellectual property rights and patents.

UNIT II COMMUNICATION AND INFORMATION TECHNOLOGY 9
Evolution of telecommunication systems – From telegraph to 5G networks – Internet architecture, cloud computing, IoT, AI, machine learning, and quantum computing – Applications in governance, smart cities, and cyber-physical systems – Limitations and challenges in scalability and security.

UNIT III ENERGY AND TRANSPORTATION SYSTEMS 9
Engineering design of combustion engines, power plants, and aerodynamics of flight – Advancements in electric vehicles, high-speed rail, and autonomous transport – Renewable energy technologies: photovoltaic cells, wind turbines, hydrogen fuel cells, bioenergy – Integration into smart grids – Case studies on sustainable energy transitions.

UNIT IV INVENTIONS IN MEDICINE AND BIOTECHNOLOGY 9
Medical imaging innovations (X-ray, MRI, PET, CT) – Engineering of biomedical devices, artificial organs, prosthetics, and implants – Nanomaterials in drug delivery and diagnostics – Genetic engineering, CRISPR, and synthetic biology – Role of AI and big data in precision healthcare.

UNIT V FRONTIER TECHNOLOGIES AND ETHICAL DIMENSIONS 9
3D printing and additive manufacturing – Robotics and autonomous systems – Space exploration technologies (rocketry, satellites, reusable launch systems) – Environmental engineering innovations (carbon capture, water purification, climate engineering) – Ethical, social, and sustainability considerations of emerging technologies.

TOTAL: 45 PERIODS

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(Signature)

TEXT BOOKS:

1. Vasant Gowariker, Science and Technology for Sustainable Development in India, 1st Edition, Sage Publications, 2020.
2. Rakesh Rathi, Nanotechnology and Smart Materials: Recent Advances and Applications, 1st Edition, CRC Press, 2021.

REFERENCES:

1. Cristiano Antonelli, Innovation and Technological Change: An Evolutionary Perspective, 2nd Edition, Routledge, 2020.
2. Pradeep Fulay and Mohammad Islam, Materials Science and Engineering: An Introduction to Concepts, 2nd Edition, CRC Press, 2021.
3. Debmalya Barh (Ed.), Genomic and Precision Medicine: Engineering and Applications, Academic Press, Elsevier, 2020.

ONLINE RESOURCES:

1. <https://www.technologyreview.com>
2. <https://technology.nasa.gov>
3. <https://spectrum.ieee.org>

COURSE OUTCOMES:

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

- CO1** Analyse the principles and historical context of major inventions and innovations.
- CO2** Evaluate the engineering design and technological basis of inventions across domains.
- CO3** Apply scientific principles to assess the efficiency, scalability, and limitations of technologies.
- CO4** Design innovative solutions by integrating interdisciplinary knowledge from engineering and science.
- CO5** Critically assess ethical, environmental, and societal implications of emerging technologies.

CO - PO MAPPING:

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

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U23OE116

PUBLIC POLICY AND GOVERNANCE

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COURSE OBJECTIVES:

- To impart Knowledge on public policy-making processes and governance structures.
- To know the role of government institutions, stakeholders, and societal actors in shaping public policies.
- To explore the challenges and opportunities for global policy cooperation.

UNIT I INTRODUCTION TO PUBLIC POLICY AND GOVERNANCE 9

Public Policy - Definition and scope, Theories of policy-making (e.g., rational choice, incrementalism, advocacy coalition framework), Models of governance (e.g., hierarchical, network, collaborative)

UNIT II POLICY ANALYSIS AND EVALUATION 9

Policy analysis - Methods and tools for policy analysis (e.g., cost-benefit analysis, policy modeling, stakeholder analysis) Criteria for evaluating policy effectiveness, efficiency, and equity Case studies of policy success and failure.

UNIT III ACTORS AND INSTITUTIONS IN PUBLIC POLICY 9

Role of government agencies, legislatures, and courts in policy-making Influence of interest groups, advocacy coalitions, and the media on policy agendas Comparative analysis of governance structures and processes in different political systems.

UNIT IV POLICY IMPLEMENTATION AND MANAGEMENT 9

Challenges and strategies in policy implementation - the role of public administration, bureaucracies, and public-private partnerships tools for monitoring, evaluation, and adaptive management of policies.

UNIT V POLICY ISSUES AND CONTEMPORARY CHALLENGES 9

Current debates and controversies in public policy (e.g., healthcare reform, climate change, immigration) Emerging policy issues (e.g., digital governance, artificial intelligence, global pandemics)

TOTAL: 45 PERIODS

TEXT BOOKS:

1. James A. Stimson, Michael B. Macken, and Robert S. Erikson, Dynamic Representation: Policy, Public Opinion, and Democracy, 2nd Edition, Cambridge University Press, 2022.
2. Thomas R. Dye., "Understanding Public Policy", 15th Edition, Pearson Publishing Co., 2021.

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REFERENCES:

1. Christopher M. Weible and Paul A. Sabatier (Eds.), Theories of the Policy Process, 5th Edition, Routledge, 2022.
2. Michael E. Kraft and Scott R. Furlong., "Public Policy: Politics, Analysis, and Alternatives", 6th Edition, CQ Press, 2020.
3. B. Guy Peters, Advanced Introduction to Public Policy, 2nd Edition, Edward Elgar Publishing, 2021.

ONLINE RESOURCES:

1. <https://www.brookings.edu>
2. <https://www.rand.org/topics/public-sector-governance.html>
3. <https://www.pewresearch.org/topic/politics-policy>

COURSE OUTCOMES:

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

- C01** Understand the concepts and theories of public policy and governance.
- C02** Analyze the interplay between government, civil society, and the private sector in policymaking processes.
- C03** Evaluate the impact of public policies on different stakeholders and societal outcomes.
- C04** Develop skills in policy analysis, advocacy, and stakeholder engagement.
- C05** Apply theoretical frameworks to real-world policy issues and case studies.
Understand the concepts and theories of public policy and governance.

CO - PO MAPPING:

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

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U230E117 **INTRODUCTION TO MOBILE COMMUNICATION** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- Understand the basics of wireless transmission systems.
- Know about the fundamentals of GSM and 3G Services, its protocols and application.
- Understand about evolution of 4G Networks, its architecture and applications.

UNIT I **INTRODUCTION TO WIRELESS TRANSMISSION** **9**

Introduction to mobile computing, Frequencies for radio transmission, Generations of Mobile Communication, Signals, Antennas ranges, Signal propagation, Multiplexing, Modulation, cellular systems.

UNIT II **WIRELESS MOBILE NETWORKS** **9**

WLAN System and Protocol architecture, IEEE 802.11a, IEEE 802.11b, HIPERLAN1/2, Bluetooth, WPAN-802.15.4, Wireless USB, Zigbee, 6LoWPAN, LoRaWAN, WiMAX.

UNIT III **MOBILE NETWORK AND TRANSPORT LAYER** **9**

Mobile IP, Registration, Tunnelling and encapsulation, IPv6, DHCP, Adhoc Routing Protocols, Multicast Routing, Traditional TCP, Classical TCP improvements, TCP over 2.5/3G wireless networks, VANET, IoT.

UNIT IV **GSM AND 3G COMMUNICATIONS SYSTEMS** **9**

Introduction to GSM, Architecture, Protocols, Connection Establishment, Frequency Allocation, Routing, Mobility Management, Security, GPRS, UMTS Architecture, LMDS, MMDS.

UNIT V **4G AND BEYOND** **9**

4G Network- Introduction, vision, features, challenges and applications, 4G Technologies- Multicarrier Modulation, Smart antenna techniques, OFDM-MIMO Systems, Software Defined Radio, Cognitive Radio, LTE, advanced LTE, Introduction to 5G Networks.

TOTAL: 45 PERIODS

TEXT BOOKS:

- 1 Jochen Schiller, "Mobile Communications", Second Edition, Pearson Education, 2012.
- 2 Vijay Garg, "Wireless Communications and networking", 1st Edition, Elsevier, 2007.

REFERENCES:

- 1 Rappaport. T. S, "Wireless Communications", 2nd Edition, Pearson Education, 2010.
- 2 Simon Haykin, Michael Moher, David Koilpillai, "Modern Wireless Communications", 1st Edition Pearson Education, 2013.
- 3 Erik Dahlman, Stefan Parkvall, Johan Skold and Per Beming, "3G Evolution HSPA and LTE for Mobile Broadband", 2nd Edition, Academic Press, 2008.

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ONLINE RESOURCES:

- 1 https://onlinecourses.nptel.ac.in/noc24_ee72/preview
- 2 https://onlinecourses.nptel.ac.in/noc21_ee66/preview
- 3 <https://www.coursera.org/learn/wireless-communications>

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

- CO1 Explain wireless transmission techniques.
- CO2 Describe various wireless mobile networking technologies.
- CO3 Explain mobile network and transport layers techniques and protocols.
- CO4 Describe fundamentals of GSM and 3G Services, its protocols and applications.
- CO5 Explain the evolution of 4G Networks, its architecture and applications.

CO - PO - PSO MAPPING:

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

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U23OE118

BASICS OF SIGNALS AND ITS PROCESSING

L T P C

3 0 0 3

COURSE OBJECTIVES:

- To understand the concept of signals, types and its properties.
- To learn about the continuous time signals by using Fourier transform and Laplace transform.
- To understand the discrete time signals in the Discrete time Fourier and Z transform domain.

UNIT I INTRODUCTION TO SIGNALS 9

Introduction to Signals, Types of time signals, Continuous and discrete signal representation, Characteristics of Signals, Standard signals- Step, Ramp, Pulse, Impulse, Real and complex, Exponentials and Sinusoids, Energy of a Signal, Power of a signal, Problems, Different types of Signal Processing..

UNIT II CLASSIFICATION OF SIGNALS 9

Classification of signals – Continuous time (CT) and Discrete Time (DT) signals, Periodic & A periodic signals, Deterministic & Random signals, Causal and Non causal Signals, Problems.

UNIT III PROPERTIES OF SIGNALS 9

Properties of Continuous and discrete time signals: Reflection, Shifting, Scaling, Reversal, Periodic composite signals, Signal and noise, Frequency spectrum and Bandwidth, Problems.

UNIT IV FREQUENCY DOMAIN REPRESENTATION OF CT SIGNALS 9

Fourier Series for periodic signals, Fourier Transform, Properties of CTFT, Gibbs Phenomena, Dirichlet Conditions, Laplace Transforms, Properties of Laplace Transforms.

UNIT V FREQUENCY DOMAIN REPRESENTATION OF DT SIGNALS 9

Baseband signal Sampling, Discrete Time Fourier Series, Discrete Time Fourier Transform, Properties of DTFT, Z Transform, and Properties of Z Transform.

TOTAL: 45 PERIODS

TEXT BOOKS:

- 1 Hwei P. Hsu, "Schaum's Outlines of Signals and Systems", 3rd Edition, Tata Mc Graw Hill, 2002.
- 2 Alan V Oppenheim, Wilsky S, Nawab S H, "Signals and Systems", Pearson Education, 2015.

REFERENCES:

- 1 B P Lathi, "Principles of Linear Systems and Signals", 2nd Edition, Oxford University Press, 2009.
- 2 R E Zeimer, W H Tranter, R D Fannin, "Signals & Systems - Continuous and Discrete", Pearson Education, 2007.
- 3 John Alan Stuller, "An Introduction to Signals and Systems", Cengage Learning, 2007.

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ONLINE RESOURCES:

- 1 https://onlinecourses.nptel.ac.in/noc21_ee20/preview
- 2 <https://nptel.ac.in/courses/117102060>
- 3 <https://www.coursera.org/learn/dsp1>

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

- CO1** Understand the fundamental concept of signals.
- CO2** Understand the different classification of signals.
- CO3** Explain the various properties of signals.
- CO4** Describe the various properties of continuous time signals and its frequency domain representation.
- CO5** Explain the various properties of Discrete time signals and its frequency domain representation.

CO - PO - PSO MAPPING:

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

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|----------|---------------------------------------|---|---|---|---|
| U23OE119 | INTRODUCTION TO COMMUNICATION SYSTEMS | L | T | P | C |
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COURSE OBJECTIVES:

- To introduce concept of basic analog and digital communication systems.
- To understand the various modulation techniques for analog and digital communication systems.
- To study the wired channel on communication systems.

UNIT I ANALOG COMMUNICATION 9

Amplitude modulation – DSBFC, square law modulator, envelope detection, Hilbert transform, SSB – frequency and phase shift methods of SSB generation – coherent detection.

UNIT II ANGLE MODULATION 9

Frequency Modulation, narrowband and wideband signals, Bessel functions, Carson's rule – bandwidth, Direct and indirect FM generation, demodulation using Phase-locked loop.

UNIT III DIGITAL COMMUNICATION 9

Nyquist sampling theorem – Pulse amplitude modulation, Pulse code modulation – Quantization – quantization noise, delta modulation, DPCM, Multiplexing and Multiple Access Techniques – FDM and FDMA, TDM and TDMA, CDMA.

UNIT IV DIGITAL MODULATION TECHNIQUES 9

Binary Phase Shift Keying – Binary Frequency Shift Keying, On-Off Keying, Optimum receiver structures for digital communication – matched filtering, correlation detection, probability of error.

UNIT V MOBILE CELLULAR COMMUNICATION 9

Evolution to cellular networks – Cellular systems generations and standards: 1G, 2G, 3G, 4G – Cellular network components – Components of a mobile phone – setting up a call process – Making a call process – Receiving a call process – Spectrum allocation: Policies and strategies, Role of TRAI.

TOTAL: 45 PERIODS

TEXT BOOKS:

- 1 Theodore S Rappaport, "Wireless Communications: Principles and Practice", 2nd Edition, Pearson Education, 2010.
- 2 Haykin S, "Communication Systems", 5th Edition, John Wiley & Sons, 2009.

REFERENCES:

- 1 Sklar B, "Digital Communications Fundamentals and Applications", 2nd Edition, Pearson Education, 2016.

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- 2 B P Lathi, "Modern Digital and Analog Communication Systems", 4th Edition, Oxford University Press, 2011.
- 3 Hwei P Hsu, "Schaum Outline Series - Analog and Digital Communications", Tata McGraw Hill, 2006.

ONLINE RESOURCES:


- 1 https://onlinecourses.nptel.ac.in/noc20_ee16/preview
- 2 <https://www.mooc-list.com/tags/communication-systems>
- 3 <https://www.coursera.org/learn/communication>

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

- CO1** Explain the basic concepts of analog communication systems.
- CO2** Apply the modulation techniques for analog communication.
- CO3** Apply the modulation techniques for digital communication.
- CO4** Explain the concepts of sampling and quantization techniques.
- CO5** Analyse the performance of wireless channels.

CO - PO - PSO MAPPING:

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

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U230E120

DRONE TECHNOLOGIES

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To understand the basics of drone concepts.
- To learn and understand the fundamentals of design, fabrication and programming drone.
- To know about the various applications of drone.

UNIT I INTRODUCTION TO DRONE TECHNOLOGY 9

Drone Concept – Vocabulary Terminology- History of drone – Types of current generation of drones based on their method of propulsion- Drone technology impact on the businesses – Drone business through entrepreneurship – Opportunities applications for entrepreneurship and employability.

UNIT II DRONE DESIGN, FABRICATION AND PROGRAMMING 9

Classifications of the UAV – Overview of the main drone parts – Technical characteristics of the parts – Function of the component parts – Assembling a drone – The energy sources – Level of autonomy – Drones configurations – The methods of programming drone – Download program Install program on computer – Running Programs – Multi rotor stabilization – Flight modes – Wi-Fi connection.

UNIT III DRONE FLYING AND OPERATION 9

Concept of operation for drone – Flight modes – Operate a small drone in a controlled Environment – Drone controls Flight operations – management tool – Sensors – On-board storage capacity – Removable storage devices – Linked mobile devices and applications.

UNIT IV DRONE COMMERCIAL APPLICATIONS 9

Choosing a drone based on the application – Drones in the insurance sector – Drones in delivering mail, parcels and other cargo – Drones in agriculture – Drones in inspection of transmission lines and power distribution – Drones in filming and panoramic picturing.

UNIT V FUTURE DRONES AND SAFETY 9

The safety risks – Guidelines to fly safely – Specific aviation regulation and standardization – Drone license – Miniaturization of drones – Increasing autonomy of drones – The use of drones in swarms.

TOTAL: 45 PERIODS

TEXT BOOKS:

- 1 Daniel Tal, John Altschuld, "Drone Technology in Architecture, Engineering and Construction: A Strategic Guide to Unmanned Aerial Vehicle Operation and Implementation", John Wiley & Sons, 2021.
- 2 Terry Kilby, Belinda Kilby, "Make: Getting Started with Drones ", Maker Media, Inc., 2016.

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REFERENCES:

- 1 John Baichtal, "Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs", Que Publishing, 2016.
- 2 Zavrnsnik, "Drones and Unmanned Aerial Systems: Legal and Social Implications for Security and Surveillance", Springer, 2018.
- 3 Sachi Nandan Mohanty, J V R Ravindra, G Surya Narayana, "Drone Technology: Future Trends and Practical Applications", John Wiley & Sons, 2023.

ONLINE RESOURCES:

- 1 <https://www.classcentral.com/subject/drones>
- 2 https://onlinecourses.nptel.ac.in/noc22_ce05/preview
- 3 <https://www.coursera.org/learn/drones-for-environmental-science>

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

- CO1** Explain about various types of drone technology, drone fabrication and programming.
- CO2** Analyse the suitable operating procedures for functioning a drone.
- CO3** Analyse the appropriate sensors and actuators for Drones.
- CO4** Design a drone mechanism for specific applications.
- CO5** Write the programs for various drones.

CO - PO - PSO MAPPING:

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

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U23OE121

GEOGRAPHICAL INFORMATION SYSTEM

L T P C
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COURSE OBJECTIVES:

- To introduce the fundamentals and components of Geographic Information System.
- To understand the types and models of Geographic Information System.
- To provide details of spatial data structures and input, management and output processes.

UNIT I FUNDAMENTALS OF GIS 9

Introduction to GIS – Basic spatial concepts – Coordinate Systems - GIS and Information Systems – Definitions – History of GIS – Components of a GIS – Hardware, Software, Data, People, Methods – Proprietary and open source Software – Types of data – Spatial, Attribute data – types of attributes – scales/ levels of measurements.

UNIT II SPATIAL DATA MODELS 9

Database Structures – Relational, Object Oriented – Entities – ER diagram - data models – Conceptual, logical and physical models - spatial data models – Raster Data Structures – Raster Data Compression – Vector Data Structures – Raster vs Vector Models – TIN and GRID data models.

UNIT III DATA INPUT AND TOPOLOGY 9

Concept of operation for drone – Flight modes – Operate a small drone in a controlled Environment – Drone controls Flight operations – management tool – Sensors – On-board storage capacity – Removable storage devices – Linked mobile devices and applications.

UNIT IV DATA QUALITY AND STANDARDS 9

Data quality – Basic aspects – completeness, logical consistency, positional accuracy, temporal accuracy, thematic accuracy and lineage – Metadata – GIS Standards – Interoperability – OGC – Spatial Data Infrastructure

UNIT V DATA MANAGEMENT AND OUTPUT 9

Import/Export – Data Management functions – Raster to Vector and Vector to Raster Conversion – Data Output – Map Compilation – Chart/Graphs – Multimedia – Enterprise Vs. Desktop GIS – distributed GIS.

TOTAL: 45 PERIODS

TEXT BOOKS:

- 1 Kang - Tsung Chang, "Introduction to Geographic Information Systems", 2nd Edition, Tata McGraw Hill, 2011.
- 2 Ian Heywood, Sarah Cornelius, Steve Carver, Srinivasa Raju, "An Introduction Geographical Information Systems", 2nd Edition, Pearson Education, 2007.

REFERENCES:

- 1 Lo C P, Albert K W Yeung, "Concepts and Techniques of Geographic Information Systems", Prentice Hall of India, 2006.

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- 2 Jonathan Campbell, Michael Shin, "Essentials of Geographic Information Systems", Saylor Foundation, 2011.
- 3 Michael N DeMers, "Fundamentals of Geographic Information Systems", 4th Edition, John Wiley & Sons, 2009.

ONLINE RESOURCES:


- 1 <https://nptel.ac.in/courses/105/102/105102015/>
- 2 https://bhuvan.nrsc.gov.in/bhuvan_links.php
- 3 <https://nptel.ac.in/courses/105/107/105107155/>

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

- CO1 Explain the basics about the fundamentals of GIS.
- CO2 Describe the types of data models.
- CO3 Explain about data input and topology.
- CO4 Apply various spatial analysis tools for deriving GIS based outcome.
- CO5 Explain data management functions and data output

CO - PO - PSO MAPPING:

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

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COURSE OBJECTIVES:

- To understand a comprehensive overview of Electric and Hybrid Electric Vehicles.
- To understand about different aspects of drive train topologies and components in HV & EV.
- To understand and advance in battery management and case studies.

UNIT I INTRODUCTION TO HYBRID ELECTRIC VEHICLES 9

History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, the impact of modern drive-trains on energy supplies, types of HV and EV, advantages over conventional vehicles, limitations of EV and HV, impact on the environment of EV and HV technology, disposal of battery cell and hazardous material and their impact on the environment.

UNIT II BASIC CONCEPT OF HYBRID TRACTION 9

Introduction to various hybrid drive-train topologies, Power flow control in hybrid drive-train topologies, Fuel efficiency analysis, braking fundamentals and regenerative braking in EVs.

UNIT III ELECTRIC COMPONENTS USED IN HYBRID AND ELECTRIC VEHICLES 9

Configuration and control of DC Motor drives, Configuration and control of Introduction Motor drives, configuration and control of Permanent Magnet Motor Drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.

UNIT IV POWER MANAGEMENT AND ENERGY SOURCES OF EV & HV 9

Power and Energy management strategies and its general architecture of EV and HV, various battery sources, energy storage, battery based energy storage and simplified models of battery, Battery Management Systems (BMS), fuel cells, their characteristics and simplified models, Super capacitor based energy storage, its analysis and simplified models, flywheels and their modelling for energy storage in HV/BEV, hybridization of various energy storage devices, Selection of the energy storage technology.

UNIT V APPLICATIONS OF EV & HV 9

Design of a Hybrid Electric Vehicle (HEV), Design of a Battery Electric Vehicle (BEV), Electric Vehicle Adoption in Urban Mobility, Electric Vehicle Integration with Renewable Energy

TOTAL: 45 PERIODS

REFERENCES:

1. Iqbal Hussain, "Electric and Hybrid Vehicles Design Fundamentals", 2nd Edition, CRC Press, 2011.
2. Chris Mi, M Abul Masrur, David Wenzhong Gao, "Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives" 1st Edition, John Wiley & Sons, 2011.

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3. Lino Guzzella, Antonio Sciarretta, Modern Electric, "Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design", 2nd Edition, CRC Press, 2009.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

- C01** Explain about the social and environmental significance, and impact of modern hybrid and electric vehicle
- C02** Describe Enhanced EV performance through diverse drives, efficiency analysis, and regenerative braking.
- C03** Explain the Improved efficiency and control in various motor drive configurations enhance performance.
- C04** Summarize on Efficient power management, battery technology understanding, and storage selection optimization
- C05** Explain about the Efficient vehicle designs, urban mobility, and renewable energy integration optimization.

CO - PO MAPPING:

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

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U230E123

INTRODUCTION TO PLC PROGRAMMING

L T P C

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COURSE OBJECTIVES:

- Understand basic PLC terminologies, digital principles, PLC architecture.
- Familiarize different programming languages of PLC.
- Develop PLC logic for simple applications using ladder logic

UNIT I INTRODUCTION TO PLC 9

Introduction to PLC: Microprocessor, I/O Ports, Isolation, Filters, Drivers, Microcontrollers/DSP, PLC/DDC - PLC Construction: What is a PLC, PLC Memories, PLC I/O, , PLC Special I/O, PLC Types.

UNIT II PLC INSTRUCTIONS 9

PLC Basic Instructions: PLC Ladder Language- Function block Programming- Ladder/Function Block functions- PLC Basic Instructions, Basic Examples (Start Stop Rung, Entry/Reset Rung)- Configuration of Sensors, Switches, Solid State Relays- Interlock examples- Timers, Counters, Examples.

UNIT III PLC PROGRAMMING 9

Introduction to the Concept of IoT Devices – IoT Devices Versus Computers – IoT Configurations – Basic Components – Introduction to Arduino – Types of Arduino – Arduino Toolchain – Arduino Programming Structure – Sketches – Pins – Input/Output From Pins Using Sketches – Introduction to Arduino Shields – Integration of Sensors and Actuators with Arduino.

UNIT IV COMMUNICATION OF PLC AND SCADA 9

Communication Protocol – Modbus, HART, Profibus- Communication facilities SCADA: - Hardware and software, Remote terminal units, Master Station and Communication architectures.

UNIT V APPLICATIONS OF PLC 9

Stepper Motor Control- Elevator Control - CNC Machine Control- conveyor control- Interlocking Problems.

TOTAL:45 PERIODS

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REFERENCES:

- 1 Madhuchhanda Mitra , Samerjit Sengupta, "Programmable Logic Controllers Industrial Automation", 1st Edition, Penram International Publishing, 2019.
- 2 J R Hackworth , F D Hackworth, "Programmable Logic Controllers Principles and Applications", 2nd Edition, Pearson Education, 2020.
- 3 Ojula, "PLC Programming & Implementation" 1st Edition, Publish Drive Publications, 2022.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

- C01 Explain basics of PLC and PLC types.
- C02 Analyse PLC basic instructions and timers.
- C03 Analyse PLC module addressing, different types of functions.
- C04 Explain communication protocol and architecture.
- C05 Analyze PLC programming in different motors.

CO - PO MAPPING:

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

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|----------|--------------------------------|---|---|---|---|
| U23OE124 | ENERGY MANAGEMENT AND AUDITING | L | T | P | C |
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COURSE OBJECTIVES:

- To enable the students to understand the concept of Energy Management
- To know the electrical load management techniques and power trading marketing
- To understand the basics of Energy audit and its economic analysis

UNIT I ENERGY SCENARIO AND BASICS OF ENERGY 9

Types of Energy Sources – Life of Energy Sources - Energy Scenario in India – Energy vs Economic Growth - Linkage between Energy Use and Environment - Need for Energy Conservation Work, Energy and Power – Electricity Basics – Energy Units.

UNIT II LIGHTING SYSTEMS 9

Energy management in lighting systems – Task and the working space - Light sources – Ballasts – Lighting controls – Optimizing lighting energy – Power factor and effect of harmonics, lighting and energy standards

UNIT III METERING FOR ENERGY MANAGEMENT 9

Metering for energy management – Units of measure - Utility meters – Demand meters – Paralleling of current transformers – Instrument transformer burdens – Multi tasking solid state meters, metering location vs requirements, metering techniques.

UNIT IV SHORT-TERM POWER TRADE MARKET 9

Electricity Act 2003- Yearly Trends in Short-term Transactions of Electricity- Time of the Day Variation in Volume and Price of Electricity Transacted through Traders and Power Exchanges-Trading Margin Charged by Trading Licensees-Open Access Consumers on Power Exchanges-Effect of Congestion on the Volume of Electricity Transacted through Power Exchanges.

UNIT V ENERGY AUDIT 9

Energy Audit Definition – Need for Energy Audit – Types of Energy Audit and Approaches – Understanding Energy Costs - Energy Performance

TOTAL: 45 PERIODS

REFERENCES

1. Arry C White, Philip S Schmidt, David R Brown, “Industrial Energy Management Systems”, 10th Edition, Hemisphere Publishing, 2023.
2. Albert Thumann, “Fundamentals of Energy Engineering”, 3rd Edition, Prentice Hall of India, 2022.
3. A S Pabla, “Electrical Power distribution”, 5th Edition, Tata McGraw Hill, 2018.

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COURSE OUTCOMES:

Upon completion of the course, students will be able to

- CO1 Summarize the Energy Scenario and Basics of Electrical Energy
- CO2 Explain the working and optimizing of Lightning System
- CO3 Describe different meters and its necessity in Energy Management
- CO4 Summarize the Short-Term Power Trade Market
- CO5 Summarize the types of Energy Audit Approaches

CO – PO MAPPING:

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

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U230E125

FUNDAMENTALS OF ROBOTICS

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COURSE OBJECTIVES:

- To understand and gain the knowledge of robotics.
- To understand and gain the knowledge of working principles of sensors and drives.
- To understand the social economical aspects and applications

UNIT I

INTRODUCTION

9

Introduction to Principles & Strategies of Automation, Types & Levels of Automation, Need of Automation, Brief History, Basic Concepts of Robotics such as Definition, Three Laws, Elements of Robotic Systems i.e. Robot Anatomy, DoF, Misunderstood Devices etc., Classification of Robotic Systems on the Basis of Various Parameters such as Work Volume, etc., Associated Parameters i.e. Resolution, Accuracy, Repeatability, Dexterity, Compliance, RCC Device etc.

UNIT II

GRIPPERS AND TRANSMISSION SYSTEMS

9

Grippers for Robotics - Types of Grippers, Guidelines for Design for Robotic Gripper, Force Analysis for Various Basic Gripper System, Degrees of Freedom - Determination of Degrees of Freedom for Four & Five Bar Mechanism, Slider Crank Mechanism, Stanford Robot and SCARA ROBOT using Grubler - Kutzbach Equation.

UNIT III

SENSORS AND DRIVES

9

Sensors: - Classification and Applications of Sensors, Characteristics of Sensing Devices, Selections of Sensors. Need for Sensors and Vision Systems in the Working and Control of a Robot. Desirable Features and Working of Tactile, Proximity and Range Sensors, Position Sensors, Velocity Sensors, Acceleration Sensors. Drives: Type of Drive, Actuators- Pneumatic, Hydraulic, Electrical and its Selection while Designing a Robot System.

UNIT IV

ROBOT PROGRAMMING AND LANGUAGES

9

Programming, WAIT, SIGNAL and DELAY Commands, Subroutines, Programming Languages: Generations of Robotic Languages, Introduction to Various Types such as VAL, RAIL, AML, python, ROS etc..

UNIT V

SOCIO-ECONOMIC ASPECTS AND APPLICATIONS

9

Socio-Economic Aspect of Robotization. Economical Aspects for Robot Design, Safety for Robot and Standards, Introduction to Artificial Intelligence, AI Techniques, Need and Application of AI. Industrial Applications of Robot in Material Transfer, Manufacturing, Inspection and Assembly

TOTAL: 45 PERIODS

REFERENCES

1. Ashitava Ghosal, "Robotics: Fundamental Concepts and Analysis", 2nd Edition, Oxford Publishers, 2008.

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2. Guruprasad K R, "Robotics: Mechanics And Control", 1st Edition, Prentice Hall of India, 2019.
3. K S Fu, Ralph Gonzalez, C S G Lee, "Robotics: Control, Sensing, Vision and Intelligence", 1st Edition, Tata McGraw Hill, 2017.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

- CO1** Explain the robot anatomy and terminologies related to Robotics technology
- CO2** Describe the gripper force and transmission systems used in robotics.
- CO3** Explain the various types, selection and need of sensors
- CO4** Explain robot programming techniques and common programming commands
- CO5** Describe socio-economic aspects, AI techniques and robot applications in the area of robotics.

CO – PO MAPPING:

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

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COURSE OBJECTIVES:

- To understand basic concepts of bio signals and bio potential electrodes
- To understand various electrode configurations.
- To understand concepts and types of bio amplifiers.

| | | |
|--|--|----------|
| UNIT I | BIO POTENTIAL ELECTRODES | 9 |
| Origin of Bio potential and its propagation. Electrode-Electrolyte interface, electrode skin interface, half-cell potential, impedance, polarization effects of electrode-non polarizable electrodes. Types of electrodes-surface, needle and micro electrodes and their equivalent circuits. Recording problems-measurement with two electrodes. | | |
| UNIT II | ELECTRODE CONFIGURATIONS | 9 |
| Bio signal characteristics- frequency and amplitude ranges ECG – Einthoven’s triangle, standard 12 lead system, EEG-10-20 electrode system, unipolar, bipolar and average mode. EMG, ERG and EOG –unipolar and bipolar mode. | | |
| UNIT III | BIO AMPLIFIER | 9 |
| Need for bio-amplifier- single ended bio amplifier, differential bio amplifier-right leg driven ECG amplifier. Band pass filtering, isolation amplifiers-transformer and optical isolation-isolated DC amplifier and AC carrier amplifier. Chopper amplifier-Power line interference. | | |
| UNIT IV | MEASUREMENT OF NON ELECTRICAL PARAMETER | 9 |
| Temperature, respiration rate and pulse rate measurements. Blood Pressure and indirect-methods-Auscultatory-method-Oscillometric-method,direct -methods, Electronic manometer. Pressure amplifiers-systolic, diastolic, mean detector circuit. Blood flow and cardiac output measurement. Indicator dilution, Thermal dilution and dye dilution method, Electromagnetic and ultrasound blood flow measurement. | | |
| UNIT V | BIOCHEMICAL MEASUREMENT | 9 |
| Biochemical sensors-pH,pO ₂ and pCO ₂ ,Ion selective Field Effective Transistor(ISFET)Immunologically sensitive FET (IMFET),Blood Glucose sensors-Blood Gas Analyzers, Calorimeter, Flame Photometer, Spectrophotometer, Blood cell counter, Auto Analyzer(simplified schematic description). | | |

TOTAL: 45 PERIODS

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REFERENCES:

- 1 R Khandpur, "Biomedical Instrumentation Technology and Applications", 4th Edition, Tata McGraw Hill, 2021.
- 2 Raghbir Singh Khandpur, "Compendium of Biomedical Instrumentation", 1st Edition, John Wiley & Sons, 2020.
- 3 John G Webster, "Medical Instrumentation: Application and Design", 5th Edition, John Wiley & Sons, 2020.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

- CO1** Explain the characteristics of bio-signals and their importance in medical diagnosis
- CO2** Describe various electrode configurations and its working methods.
- CO3** Comprehend concepts and types of bio amplifiers in medical instrumentation.
- CO4** Explain different measurement methods of non- electrical parameters in medical instrumentation.
- CO5** Summarize concepts about different biochemical measurements.

CO - PO MAPPING:

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

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U230E137

APPLIED DESIGN THINKING

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Course Objectives:

- Introduce tools & techniques of design thinking for innovative products.
- Development Illustrates customer-centric product innovation using simple.
- Describe system thinking principles as applied to complex systems.

UNIT I DESIGN THINKING PRINCIPLES 9

Exploring Human-centered Design - Understanding the Innovation process, discovering areas of opportunity, Interviewing & empathy-building techniques, Mitigate validation risk with FIR [Forge Innovation rubric] - Case studies.

UNIT II END USER-CENTRIC INNOVATION 9

Importance of customer-centric innovation - Problem Validation and Customer Discovery - Understanding problem significance and problem incidence - Customer Validation. Target user, User persona & user stories. Activity: Customer development process - Customer interviews and field visit.

UNIT III APPLIED DESIGN THINKING TOOLS 9

Concept of Minimum Usable Prototype [MUP] - MUP challenge brief - Designing & Crafting the value proposition - Designing and Testing Value Proposition; Design a compelling value proposition; Process, tools and techniques of Value Proposition Design.

UNIT IV CONCEPT GENERATION 9

Solution Exploration, Concepts Generation and MUP design- Conceptualize the solution concept; explore, iterate and learn; build the right prototype; Assess capability, usability and feasibility. Systematic concept generation; evaluation of technology alternatives and the solution concepts.

UNIT V SYSTEM THINKING 9

System Thinking, Understanding Systems, Examples and Understandings, Complex Systems.

TOTAL : 45 PERIODS

TEXT BOOKS:

- 1 Maurício Vianna, Ysmar nVianna, Brenda Lucena, Beatriz Russo, "Design thinking: Business innovation", 1st Edition, MJV Technologies and innovation press, 2021.
- 2 George E Dieter, "Engineering design", 4th Revised edition, Tata McGraw Hill, 2019.

REFERENCES:

- 1 Len Bass, Ingo Weber, Liming Zhu G, DevOps, "A Software Architect's Perspective", 1st Edition, Addison-Wesley Professional, 2019.
- 2 Tim Brown, "Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation", 2nd Edition, Harper Business, 2019.
- 3 Stephen Fleming, Pravin, "Introduction of DevOps Resource Management", 1st Edition, Create space Independent Publications, 2020.

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ONLINE RESOURCES:

- 1 <https://archive.nptel.ac.in/courses/112/105/112105316/>
- 2 <https://www.shutterstock.com/video/search/design-thinking>
- 3 https://onlinecourses.nptel.ac.in/noc22_mg32/preview

COURSE OUTCOMES:

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

- C01** Design various hypotheses to mitigate the inherent risks in product innovations.
- C02** Design the solution concept based on the proposed value by exploring alternate solutions to achieve value-price fit.
- C03** Apply the critical thinking, analysing, storytelling & pitching.
- C04** Apply system thinking in a real-world scenario.
- C05** Create the right prototype with Assess capability with solution concept.

CO - PO - PSO MAPPING:

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

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U230E138

FIRE SAFETY ENGINEERING

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Course Objectives:

- To enable the students to acquire knowledge of Fire and Safety Studies.
- To learn about the effect of fire on materials used for construction, the method of test for non-combustibility & fire resistance.
- To learn about fire areas, fire stopped areas and different types of fire-resistant doors

UNIT I INHERENT SAFETY CONCEPTS 9

Compartment fire-factors controlling fire severity, ventilation controlled and fuel controlled fires; Spread of fire in rooms, within buildings and between buildings. Effect of temperature on the properties of structural materials- concrete, steel, masonry and wood; Behaviour of non-structural materials on fire- plastics, glass, textile fibres and other household materials.

UNIT II PLANT LOCATIONS 9

Compartment temperature-time response at pre-flashover and post flashover periods; Equivalence of fire severity of compartment fire and furnace fire; Fire resistance test on structural elements standard heating condition, Indian standard test method, performance criteria.

UNIT III WORKING CONDITIONS 9

Fire separation between building- principles of calculation of safe distance. Design principles of fire resistant walls and ceilings; Fire resistant screens- solid screens and water curtains; Local barriers; Fire stopped areas-in roof, in fire areas and in connecting structures; Fire doors- Low combustible, Non-combustible and Spark-proof doors; method of suspension of fire doors; Air-tight sealing of doors.

UNIT IV FIRE SEVERITY AND REPAIR TECHNIQUES 9

Fabricated fire proof boards-calcium silicate, Gypsum, Vermiculite, and Perlite boards; Fire protection of structural elements - Wooden, Steel and RCC.. Reparability of fire damaged structures Assessment of damage to concrete, steel, masonry and timber structures, Repair techniques- repair methods to reinforced concrete Columns, beams and slabs, Repair to steel structural members, Repair to masonry structures.

UNIT V WORKING AT HEIGHTS 9

Safe Access - Requirement for Safe Work Platforms- Stairways - Gangways and Ramps- Fall Prevention & Fall Protection - Safety Belts - Safety nets - Fall Arrestors- Working on Fragile Roofs -Work Permit Systems-Accident Case Studies.

TOTAL : 45 PERIODS

TEXT BOOKS:

- 1 Roytman M Y, "Principles of fire safety standards for building construction", 1st Edition, Amerind Publishing Co. Pvt. Ltd., 2018.
- 2 John A Purkiss, "Fire safety engineering design of structures", 2nd Edition, Butter worth Heinemann, 2019.

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REFERENCES:

- 1 Smith E E, and Harmathy T Z, "Design of buildings for fire safety", 1st Edition, ASTM Special Publication, 2018.
- 2 Jain V K, "Fire safety in buildings", 1st Edition, New Age International Pvt. Ltd., 2020.
- 3 Hazop & Hazan, "Identifying and Assessing Process Industry Hazards", 4th Edition, CRC Press, 2019.

ONLINE RESOURCES:

- 1 <https://archive.nptel.ac.in/courses/105/102/105102176/>
- 2 <https://3danimation.in/projects/safety-animation-fire-safety-video/>
- 3 https://onlinecourses.nptel.ac.in/noc20_ce09/preview

COURSE OUTCOMES:

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

- CO1** Describe the effect of fire on materials used for construction.
- CO2** Describe the method of test for non-combustibility and fire resistance.
- CO3** Describe the design concept of fire walls, fire screens, local barriers and fire doors and able to select to prevent fire spread.
- CO4** Apply the method of fire protection to RCC, steel, and wooden structural elements and their repair methods if damaged due to fire.
- CO5** Describe the safety techniques and improve the analytical and intelligence to take the right decision at right time.

CO - PO - PSO MAPPING:

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

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U230E139

FUNCTIONAL MATERIALS

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COURSE OBJECTIVES:

- To impart an insight in differentiating among various functional properties.
- To describe the selection of appropriate material for certain functional applications.
- To study about the analysis of the nature and potential of functional materials.

UNIT I INTRODUCTION 9

Historical Perspectives, Lessons from the Nature, Engineering the Functions, Tuning the functions, Multiscale Modelling and Computation, Classification of Functional Materials, Functional Diversity of Materials, Hybrid Materials, Technological Relevance, Societal Impact.

UNIT II MOLECULAR SELF ASSEMBLY 9

Molecular Organization, Self-Assembly in Biology, Energetics of self-Organization, A few case studies, Synthetic Protocols and challenges, Solvent assisted self-assembly, Directed assembly-Langmuir-Blodgett and Langmuir-Schaefer techniques, Technological applications of SAMs.

UNIT III BIO-INSPIRED MATERIALS 9

Bio-inspired materials, Classification, Biomimicry, Spider Silk, Lotus Leaf, Gecko feet, Synovial fluid, 'Bionics'-Bio-inspired Information Technologies, Artificial Sensory Organs, Biomineralization- En route to Nanotechnology.

UNIT IV SMART OR INTELLIGENT MATERIALS 9

Criteria for Smartness, Significance of Smart Materials, Representative Examples like Smart Gels and Polymers, Electro/Magneto Rheological Fluids, Smart Electro ceramics, Technical Limitations and Challenges, Functional Nanocomposites, Polymer-carbon nanotube composites.

UNIT V MATERIALS FOR POLYMER ELECTRONICS 9

Polymers for Electronics, Organic Light Emitting Diodes, Working Principle of OLEDs, Illustrated Examples, Organic Field-Effect Transistors Operating Principle, Design Considerations, Polymer FETs vs Inorganic FETs, Liquid Crystal Displays, Engineering Aspects of Flat Panel Displays, Intelligent Polymers for Data Storage, Polymer-based Data Storage-Principle, Magnetic Vs. Polymer-based Data Storage.

TOTAL: 45 PERIODS

TEXT BOOKS:

- 1 Vijayamohan K Pillai, Meera Parthasarathy, "Functional Materials: A chemist's perspective", 1st Edition, Universities Press, 2018.

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- Deborah D L Chung, "Functional Materials: Electrical, Dielectric, Electromagnetic, Optical and Magnetic applications", 1st Edition, World Scientific Publishing, 2020.

REFERENCES:

- Stephen Manne, "Biomimetic Materials Chemistry", 1st Edition, Wiley-VCH, 2018.
- S Banerjee, A K Tyagi, "Functional Materials: Preparation, Processing and Applications," 1st Edition, Elsevier Science, 2018.
- Dipti Ranjan Sahu, "Functional Materials," 1st Edition, Intech Open, 2019.
- Mohsen Shahinpoor, "Fundamentals of Smart Materials," 1st Edition, Royal Society of Chemistry, 2020.

ONLINE RESOURCES:

- https://onlinecourses.nptel.ac.in/noc23_ph34/preview
- <https://royalsociety.org/news-resources/projects/animate-materials/>
- <https://nptel.ac.in/courses/112104173>

COURSE OUTCOMES:

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

- CO1** Explain Multi-scale Modelling and Computation and classify the functional materials.
- CO2** Explain the molecular self-assembly and technological applications of SAMs.
- CO3** Apply the various bio inspired materials, artificial sensory organs and nano technology in bio mineralization.
- CO4** Describe the applications of smart materials, nano composites and nano-tube composites.
- CO5** Apply the concept polymer electronics in Organic and Light Emitting Diodes, transistors and LEDs.

CO - PO - PSO MAPPING:

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

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|-----------------|---|----------|----------|----------|----------|
| U23OE140 | FUNDAMENTALS OF AERONAUTICAL ENGINEERING | L | T | P | C |
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Course Objectives:

- To acquire the knowledge on the Historical evaluation of Airplanes.
- To learn the different component structures, construction, systems and functions.
- To study about the analysis of the nature and potential of functional materials.

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|---|---|----------|
| UNIT I | HISTORY OF FLIGHT | 9 |
| Balloon flight-ornithopter-Early Airplanes by Wright Brothers, biplanes and monoplanes, Developments in aerodynamics, materials, structures and propulsion over the years. | | |
| UNIT II | AIRCRAFT CONFIGURATIONS AND ITS CONTROLS | 9 |
| Different types of flight vehicles, classifications-Components of an airplane and their functions- Conventional control, powered control- Basic instruments for flying-Typical systems for control actuation. | | |
| UNIT III | BASICS OF AERODYNAMICS | 9 |
| Physical Properties and structures of the Atmosphere, Temperature, pressure and altitude relationships, Newton's Law of Motions applied to Aeronautics-Evolution of lift, drag and moment. Aerofoils, Mach number, Maneuvers. | | |
| UNIT IV | BASICS OF AIRCRAFT STRUCTURES | 9 |
| General types of construction, Monocoque, semi-monocoque and geodesic constructions, typical wing and fuselage structure. Metallic and non-metallic materials. Use of Aluminium alloy, titanium, stainless steel and composite materials. Stresses and strains-Hooke's law- stress-strain diagrams- elastic constants-Factor of Safety. | | |
| UNIT V | BASICS OF PROPULSION | 9 |
| Basic ideas about piston, turboprop and jet engines – use of propeller and jets for thrust production- Comparative merits, Principle of operation of rocket, types of rocket and typical applications, Exploration into space. | | |


TOTAL : 45 PERIODS

TEXT BOOKS:

- 1 Anderson J D, "Introduction to Flight", 8th Edition, Tata McGraw-Hill, 2018.
- 2 Rathakrishnan E, "Introduction to Aerospace Engineering: Basic Principles of Flight", 1st Edition, John Wiley & sons, 2021.

REFERENCES:

- 1 Stephen A Brandt, "Introduction to aeronautics: A design perspective", 2nd Edition, AIAA Education Series, 2019.
- 2 Sadhu Singh, "Internal Combustion Engines and Gas Turbine", 1st Edition, SS Kataria & Sons, 2018.
- 3 Shevell, "Fundamentals of Flight", 2nd Edition, Pearson Education, 2018.


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ONLINE RESOURCES:

- 1 <http://digimat.in/nptel/courses/video/101106033/L01.html>
- 2 <http://www.digimat.in/nptel/courses/video/101101083/L20.html>
- 3 <http://www.digimat.in/nptel/courses/video/101101001/A01.html>

COURSE OUTCOMES:

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

- CO1** Describe the history of aircraft & developments over the years.
- CO2** Describe the types & classifications of components and control systems.
- CO3** Explain the basic concepts of flight & Physical properties of Atmosphere.
- CO4** Explain the types of fuselage and constructions.
- CO5** Describe the types of Engines and the Rocket.

CO - PO - PSO MAPPING:

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

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| | | | | | |
|-----------------|---|----------|----------|----------|----------|
| U23OE141 | INDUSTRIAL DESIGN & RAPID PROTOTYPING TECHNIQUES | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

Course Objectives:

- Outline Fundamental concepts in UI & UX and Introduce the principles of Design and Building an mobile app.
- Illustrate the use of CAD in product design Outline the choice and use of prototyping tools.
- Understanding design of electronic circuits and fabrication of electronic devices.

UNIT I **UI/UX** **9**

Fundamental concepts in UI & UX - Tools - Fundamentals of design principles - Psychology and Human Factors for User Interface Design - Layout and composition for Web, Mobile and Devices - Typography - Information architecture - Color theory - Design process flow, wireframes, best practices in the industry -User engagement ethics - Design alternatives.

UNIT II **APP DEVELOPMENT** **9**

SDLC - Introduction to App Development - Types of Apps - web Development understanding Stack -Frontend - backend - Working with Databases - Introduction to API Introduction to Cloud services - Cloud environment Setup- Reading and writing data to cloud - Embedding ML models to Apps - Deploying application.

UNIT III **INDUSTRIAL DESIGN** **9**

Introduction to Industrial Design - Points, lines, and planes - Sketching and concept generation - Sketch to CAD - Introduction to CAD tools - Types of 3D modelling - Basic 3D Modelling Tools - Part creation – Assembly - Product design and rendering basics - Dimensioning & Tolerancing.

UNIT IV **MECHANICAL RAPID PROTOTYPING** **9**

Need for prototyping - Domains in prototyping - Difference between actual manufacturing and prototyping - Rapid prototyping methods - Tools used in different domains - Mechanical Prototyping; 3D Printing and classification - Laser Cutting and engraving - RD Works - Additive manufacturing.

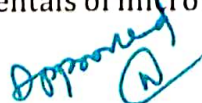
UNIT V **ELECTRONIC RAPID PROTOTYPING** **9**

Basics of electronic circuit design - lumped circuits - Electronic Prototyping - Working with simulation tool - simple PCB design with EDA.

TOTAL : 45 PERIODS

TEXT BOOKS:

- 1 Peter Fiell, "Charlotte Fiell, Industrial Design A-Z", 1st Edition, TASCHEN, 2018.
- 2 Madou M J, "Fundamentals of micro fabrication", 1st Edition, CRC Press, 2019.

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REFERENCES:

- 1 Jaeger R C, "Introduction to microelectronic Fabrication", 1st Edition, Addison Wesley Publishing Co., 2020.
- 2 Amstead B H, Ostwald Phylips, Bageman R, "Manufacturing Processes", 1st Edition, John Wiley & Sons, 2018.
- 3 Serope Kalpakjian, "Manufacturing Engineering and Technology", 3rd Edition, Addison Wesley Publishing Co., 2019.

ONLINE RESOURCES:

- 1 <http://www.digimat.in/nptel/courses/video/112107217/L20.html>
- 2 https://onlinecourses.nptel.ac.in/noc22_mm33/preview
- 3 <https://archive.nptel.ac.in/courses/112/104/112104265/>

COURSE OUTCOMES:

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

- C01 Create quick UI/UX prototypes for customer needs.
- C02 Create web application to test product traction / product feature.
- C03 Design a 3D models for prototyping various product ideas.
- C04 Create prototypes using Tools and Techniques in a quick iterative methodology.
- C05 Describe the electronic rapid prototyping.

CO - PO - PSO MAPPING:

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

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U230E201

STATISTICS AND NUMERICAL METHODS

L T P C

3 0 0 3

COURSE OBJECTIVES:

- To acquaint the knowledge of testing of hypothesis for small and large samples and design of experiments which plays an important role in real life applications.
- To introduce the basic concepts of solving algebraic and transcendental equations and introduce the numerical techniques of interpolation in various intervals and to solve differentiation and integration.
- To understand the knowledge of various techniques and methods of solving ordinary differential equations.

UNIT I TESTING OF HYPOTHESIS 9

Sampling distributions – Tests for single mean, proportion and difference of means (Large and small samples) – Tests for single variance and equality of variances – Chi square test for goodness of fit – Independence of attributes.

UNIT II DESIGN OF EXPERIMENTS 9

One way and two – way classifications – Completely randomized design – Randomized block design – Latin square design.

UNIT III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 9

Solution of algebraic and transcendental equations – Fixed point iteration method – Newton – Raphson method – Solution of linear system of equations – Gauss elimination method – Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel – Eigen values of a matrix by Power method and Jacobi's method for symmetric matrices.

UNIT IV INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION 9

Lagrange's and Newton's divided difference interpolations – Newton's forward and backward difference interpolation – Approximation of derivatives using interpolation polynomials – Numerical single and double integrations using Trapezoidal and Simpson's 1/3 rules.

UNIT V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS 9

Single step methods: Taylor's series method – Euler's method – Modified Euler's method – Fourth order Runge – Kutta method for solving first order differential equations – Multi step methods: Milne's and Adams – Bash forth predictor corrector methods for solving first order differential equations.

TOTAL: 45 PERIODS

TEXT BOOKS:

- 1 B S Grewal, J S Grewal, "Numerical Methods in Engineering and Science", 11th Edition, Khanna Publishers, 2021.
- 2 R A Johnson, I Miller, J Freund "Miller and Freund's Probability and Statistics for Engineers", 9th Edition, Pearson Education, 2017.

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REFERENCES:

1. Chaitanya Kumar, Harindejit Kaur Chawla, Indarpal Singh, "A text book on Numerical Methods and Analysis", Sultan Chand & Sons, 2024.
2. P Sivaramakrishna Das, C Vijayakumari, "Statistics and Numerical Methods", 9th Edition, Pearson Education, 2020.
3. S C Gupta , V K Kapoor, "Fundamentals of Mathematical Statistics", 12th Edition, Sultan Chand & Sons, 2020.

ONLINE RESOURCES:

1. https://swayam.gov.in/nd2_cec20_ma01/preview
2. <https://www.coursera.org/learn/intro-to-numerical-analysis>
3. <https://www.mooc-list.com/tags/numerical-methods>

COURSEOUTCOMES:

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

- CO1** Analyze the concepts of sampling, mean and variance using various statistical tests.
CO2 Analyze the concepts of design of experiments using ANOVA.
CO3 Solve the algebraic and numerical equations by numerical techniques.
CO4 Evaluate the numerical integration and differentiation using different methods.
CO5 Solve the first order differential equations by various methods.

CO-PO MAPPING:

| | P01 | P02 | P03 | P04 | P05 | P06 | P07 | P08 | P09 | P010 | P011 | P012 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | 3 | 3 | 2 | 2 | - | - | - | 1 | - | - | - | 1 |
| CO2 | 3 | 3 | 2 | 2 | - | - | - | 1 | - | - | - | 1 |
| CO3 | 3 | 2 | 1 | 1 | - | - | - | - | - | - | - | - |
| CO4 | 3 | 3 | 2 | 3 | - | - | - | 1 | - | - | - | 1 |
| CO5 | 3 | 2 | 1 | 1 | - | - | - | - | - | - | - | - |

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U23OE202

RESOURCE MANAGEMENT TECHNIQUES

L T P C
3 0 0 3

COURSE OBJECTIVES:

- Learn to formulate linear programming problems and solve LPP using simple algorithm.
- Learn to solve networking problems.
- Learn to formulate and solve integer programming problems.

UNIT I LINEAR PROGRAMMING 9

Principal components of decision problem – Modeling phases – LP formulation and graphic solution – Resource allocation problems – simplex method – sensitivity analysis.

UNIT II DUALITY AND NETWORKS 9

Definition of dual problems – primal – Dual relationships – Dual simplex method – post optimality analysis – Transportation and assignment model – Shortest route problem.

UNIT III INTEGER PROGRAMMING 9

Cutting plan algorithm – Branch and bound methods, Multistage (Dynamic) programming.

UNIT IV CLASSICAL OPTIMISATION THEORY 9

Unconstrained external problems, Newton – Raphson method – Equality constraints – Jacobean methods – Lagrangian method – Kuhn – Tucker conditions – Simple problems.

UNIT V OBJECTS SCHEDULING 9

Network diagram representation – Critical path method – Time charts and resource leveling – PERT

TOTAL: 45 PERIODS

TEXT BOOKS:

1. H A Eiselt, Carl Louis Sandblom, "Operation Research", Springer, 2022.
2. Girish G.Pathak, "Operation Research", Tech Knowledge Publications, 2021.

REFERENCES:

1. Pundir S K, "Operation Research", CBS, 2020.
2. Bhupander Singh, S K Pundir, Amardeep, "Operation Research", A Pragati Edition, 2020.
3. S Hillier Frederick, J Lieberman Gerald, Nag Bodhibroto, Basu Preetam, "Introduction to Operation Research" Tata McGraw Hill, 2021.

ONLINE RESOURCES:

1. <https://nptel.ac.in/courses/112106134>
2. <https://nptel.ac.in/courses/112106134>
3. <https://archive.nptel.ac.in/courses/111/104/111104027/>

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COURSEOUTCOMES:

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

- C01** Solve LPP using simple algorithm
- C02** Solve networking problems.
- C03** Solve integer programming problems.
- C04** Solve Non Linear programming problems.
- C05** Solve project management problems.

CO - PO MAPPING:

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

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U230E203

GRAPH THEORY

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To understand and apply the fundamental concepts in graph theory.
- Able to demonstrate their knowledge of algorithms by solving concrete problems.
- To apply graph theory based tools in solving practical problems.

UNIT I

INTRODUCTION

9

Spanning trees – Fundamental circuits – Spanning trees in a weighted graph – cut sets – Properties of cut set – All cut sets – Fundamental circuits and cut sets – Connectivity and separability – 1-Isomorphism – 2-Isomorphism – Combinational and geometric graphs – Planar graphs – Different representation of a planar graph.

UNIT II

TREES, CONNECTIVITY & PLANARITY

9

Spanning trees – Fundamental circuits – Spanning trees in a weighted graph – cut sets Properties of cut set – All cut sets – Fundamental circuits and cut sets Connectivity and separability – 1-Isomorphism – 2-Isomorphism – Combinational and geometric graphs – Planar graphs – Different representation of a planar graph.

UNIT III

MATRICES, COLOURING & COVERING

9

Incidence matrix – Sub matrices – Circuit Matrix - Fundamental circuit matrix – Cut set, Path, Adjacency Matrix - Chromatic number – Chromatic partitioning – Chromatic polynomial – Matching – Covering – Four colour problem .

UNIT IV

DIRECTED GRAPH

9

Directed graphs – Types of directed graphs – Digraphs and binary relations – Directed paths and connectedness – Euler graphs – Trees with Directed edges – Matrices of Digraphs.

UNIT V

GENERATING FUNCTIONS & RECURRENCE RELATIONS

9

Generating functions - Partitions of integers - Exponential generating function – Summation operator – Recurrence relations – First order and second order – Non-homogeneous recurrence relations – Method of generating functions.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. N P Shrimal, Nita H Shah, "Recent Advancements in Graph Theory ", CRC Press, 2020.
2. S B Singh, "Combinatorics and Graph Theory ", Khanna Publishing House, 2022.

REFERENCES:

1. Harun Pirim, "Recent Applications in Graph Theory", Intechopen, 2022.
2. Mark Anderson, Jonathan L Gross, Jay Yellen, "Graph Theory and its Applications", CRC Press, 2024.
3. Karin R Saoup, "Graph Theory", Chapman and Hall/CRC, 2021.

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ONLINE RESOURCES:

- 1 https://swayam.gov.in/nd1_noc20_ma05/preview
- 2 <https://dzone.com/articles/the-top-13-resources-for-understandinggraph-theory>
- 3 <http://www.nitttrc.edu.in/nptel/courses/video/106104170/L22.html>

COURSE OUTCOMES:

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

- C01** Explain concepts of graph theory that is walk, path, isomorphism etc.
C02 Apply various substructures of trees and investigate the planarity of graphs.
C03 Apply the concepts of Colouring, matching and chromatic number in theorems.
C04 Explain digraphs and Euler graphs.
C05 Solve recurrence relations using generating functions.

CO - PO MAPPING:

| | P01 | P02 | P03 | P04 | P05 | P06 | P07 | P08 | P09 | P010 | P011 | P012 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| C01 | 2 | 2 | 1 | 1 | - | - | - | - | - | - | - | - |
| C02 | 3 | 2 | 1 | 2 | - | - | - | 1 | - | - | - | - |
| C03 | 3 | 2 | 1 | 2 | - | - | - | 1 | - | - | - | 1 |
| C04 | 2 | 2 | 1 | 1 | - | - | - | - | - | - | - | 1 |
| C05 | 3 | 2 | 1 | 1 | - | - | - | 1 | - | - | - | - |

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ONLINE RESOURCES:

1. <https://nptel.ac.in/courses/111/105/111105100/>
2. <https://nptel.ac.in/courses/112/106/112106134/>
3. <https://freevideolectures.com/course/2678/advanced-operations-research>

COURSE OUTCOMES:

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

- C01** Solve linear programming models.
- C02** Apply the concepts of transportation and assignment models in real life applications.
- C03** Analyze the project schedule and the cost-time trade-offs in the context of a project network and optimal decisions using graphical approach.
- C04** Estimate the total elapsed time for the problems of multiple jobs and machines in a production line and understand the various selective inventory control techniques and its applications.
- C05** Analyze the quantitative metrics of performance for queuing systems.

CO- PO MAPPING:

| | P01 | P02 | P03 | P04 | P05 | P06 | P07 | P08 | P09 | P010 | P011 | P012 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| C01 | 3 | 2 | 1 | 1 | - | - | - | - | - | - | - | 1 |
| C02 | 3 | 2 | 1 | 2 | - | - | - | - | - | - | - | 1 |
| C03 | 3 | 3 | 2 | 2 | - | - | - | 1 | - | - | - | - |
| C04 | 3 | 3 | 2 | 3 | - | - | - | 1 | - | - | - | 1 |
| C05 | 3 | 3 | 2 | 2 | - | - | - | 1 | - | - | - | - |

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| | | | | | |
|-----------------|--|----------|----------|----------|----------|
| U23OE205 | SCIENTIFIC PRINCIPLES IN HISTORICAL MONUMENTS | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

COURSE OBJECTIVES:

- To recall the historical background of the monuments.
- To recognize the different scientific principles in the maintenance of historical monuments.
- To identify the knowledge of construction techniques used in historical period.

UNIT I **CHARACTERISTICS OF MONUMENTS** **9**
 Definition - Materials used - Purpose-Functions - Types: religious, secular, palaces, forts, tombs, bridges - irrigation systems - need for conservation.

UNIT II **HISTORY OF CONSTRUCTION TECHNOLOGIES** **9**
 Chronological development - Ancient civilizations - Ancient period - Medieval construction-construction in the modern period - technical achievements.

UNIT III **BASIC PHYSICS PRINCIPLES** **9**
 Stability and equilibrium: leaning tower of Pisa – Tension, stress and strain: bridges – Overcoming forces: sledges, pulleys and elevators.

UNIT IV **TECHNIQUES OF CONSTRUCTION** **9**
 Mechanical energy to move large stones –use of counter weights and counter ramps.

UNIT V **ANCIENT TECHNIQUES** **9**
 Hydraulic transport of building material –use of levers and pivot walking.

TEXT BOOKS:

- 1 Halliday, Resnick, "Principles of Physics", 12th Edition, John Wiley & Sons, 2023.
- 2 Mila Powers, "Conservation science for Cultural Heritage", Willford Press, 2022.

REFERENCES:

1. Paula Pires, Joao Mascarenhas, "History of Construction Cultures", Taylor & Francis, 2021.
2. Claire Smith, "Encyclopedia of Global Archaeology", Springer, 2021.
3. Paul G Hewitt, "Conceptual Physics", 13th Edition, Pearson Education, 2024.

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ONLINE RESOURCES:

- 1 <https://doi.org/10.1038/s40494-025-01640-y>
- 2 <https://orcid.org/0000-0003-0049-8171>
- 3 <https://doi.org/10.70102/afts.2024.1631.036>

COURSE OUTCOMES:

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

- C01** Summarize the characteristics of historical monuments.
- C02** Summarize the different scientific principles in designing and construction of historical monuments.
- C03** Apply the basic physics principles in maintenance of historical monuments.
- C04** Describe the history of construction technologies in various era.
- C05** Explain the techniques of construction used in olden days.

CO – PO MAPPING:

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

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U23OE206

NON-CONVENTIONAL ENERGY SOURCES

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To compare different forms of energy.
- To acquire knowledge of different methods of harvesting energy.
- To recognize the use of alternate sources of energy.

UNIT I SOLAR ENERGY 9

Sun Earth radiation spectra – Solar Radiation Data – Measurement of Solar Radiation data – Solar collectors – Solar water Heater – Solar cookers – Solar Greenhouse effect – Solar Cell fundamentals – a typical solar electric installation for home (solar panels, battery and inverter)

UNIT II WIND ENERGY 9

Origin of wind – Nature of wind – Wind Turbine Siting – Major Applications of Wind Power – Main components of the horizontal axis wind turbine – Wind Energy Conversion systems – Wind – Diesel Hybrid System.

UNIT III BIOMASS ENERGY 9

Introduction – Photosynthesis Process – Biofuels – Biomass Resources – Biomass conversion technologies – Urban Waste to Energy Conversion – Biomass Gasification – Biomass to Ethanol production – Biogas Production from Waste Biomass.

UNIT IV CHEMICAL ENERGY SOURCES 9

Fuel cells – design and principle of operation of a fuel cell – Classification of fuel cells – Types of Fuel cells – Hydrogen and fossil fuel cell – Advantages and disadvantages of fuel cells.

UNIT V DIFFERENT TYPES OF BATTERY 9

Batteries : Basic battery theory – Different types of battery arrangement – classification of batteries – Lead – Acid battery – Nickel cadmium battery – Li-ion battery – batteries used in portable devices (laptops, cell phones, pace makers).

TOTAL:45 PERIODS

TEXT BOOKS:

1. B H Khan , "Non-Conventional Energy Resources", Tata McGraw Hill, 2024.
2. G D Rai , "Non-Conventional Energy Sources", 4th Edition, Khanna Publishers, 2023.

REFERENCES:

1. D P Kothari, K C Singal, Rakesh Ranjan, "Renewable energy sources and emerging technologies", 3rd Edition, Prentice Hall of India, 2022.
2. Mehmet Kanoglu, Yunus A Cengel, John M Imbala, "Fundamentals and Applications of Renewable Energy", 2nd Edition, Tata McGraw Hill, 2023.
3. G S Sawhney, "Non-Conventional Energy Resources", Prentice Hall of India, 2024.

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ONLINE RESOURCES:

1. <https://www.ipcc.ch/site/assets/uploads/2018/03/Chapter-7-Wind-Energy-1.pdf>
2. <https://archive.nptel.ac.in/content/storage2/courses/108108078/pdf/S>
3. <https://ebooks.inflibnet.ac.in/esp07/chapter/biomass-as-an-energy-source/>

COURSE OUTCOMES:

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

- CO1** Explain the fundamentals of different forms of solar energy.
CO2 Describe the origin, nature and applications of wind energy.
CO3 Explain the process involved in production and conversion of biomass energy.
CO4 Describe the design and principles of fuel cells.
CO5 Explain the basic theory and types of batteries.

CO - PO MAPPING:

| | P01 | P02 | P03 | P04 | P05 | P06 | P07 | P08 | P09 | P010 | P011 | P012 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | 2 | 2 | 1 | 1 | - | - | - | - | - | - | - | - |
| CO2 | 2 | 2 | 1 | 1 | - | - | - | - | - | - | - | - |
| CO3 | 2 | 2 | 1 | 1 | - | - | - | - | - | - | - | 1 |
| CO4 | 2 | 2 | 1 | 1 | - | - | - | - | - | - | - | - |
| CO5 | 2 | 2 | 1 | 1 | - | - | - | - | - | - | - | - |

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U23OE207

ENVIRONMENTAL PHYSICS

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To relate the connection between physics and human environment.
- To recognize the structure, composition of the atmosphere and the global weather conditions.
- To identify the use of renewable energy resources.

UNIT I PHYSICS IN HUMAN ENVIRONMENT 9

Laws of thermodynamics – thermodynamics and the human body – Energy and metabolism - Energy transfers: Concepts of Conduction, Convection, Radiation and Evaporation – Survival in cold and hot climates.

UNIT II THE URBAN ENVIRONMENT 9

Townscape – Energy in the city – Transportation – Water for urban environment – Lighting – Urban pollution – Smog – Acid rain – Car as an urban pollutant – Noise pollution.

UNIT III ENERGY FOR LIVING 9

World energy demand – World energy supplies – Basic concepts of Energy sources: Fossil fuels – Wind energy – Solar energy – Tidal energy.

UNIT IV GEOTHERMAL AND HYDRO ENERGY 9

Geothermal Resources – Geothermal Technologies – Hydro Energy: Hydropower resources – hydropower technologies – environmental impact of hydro power sources.

UNIT V RADIATION PROTECTION 9

Nuclear radiation: exposure rate, dose rate, equivalent dose rate, population dose – quantitative effects of radiation on the human species – calculation – nuclear reactor – shielding.

TOTAL: 45 PERIODS

TEXT BOOKS:

- 1 Abel Rodrigues, Gabriel Pita, Raul Albuquerque Sardinha, "Fundamental Principles of Environmental Physics", Springer, 2022.
- 2 Pranav Kumar, "Fundamentals of Ecology and Environment" , 2nd Edition, Pathfinder Publication, 2021.

REFERENCES:

- 1 Khan B H, "Non-Conventional Energy Resources", Tata McGraw Hill, 2024.
- 2 Kyle Forinash, "Foundations of Environmental Physics", Island Press, 2022.
- 3 C Francesco, "Advances in Environmental Applied Physics", MDPI, 2023.

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ONLINE RESOURCES:

- 1 http://en.wikipedia.org/wiki/Renewable_energy
- 2 https://www.uprm.edu/aret/docs/Ch_3_Ocean.pdf
- 3 <https://ebooks.inflibnet.ac.in/esp07/chapter/applications-of-solar-energy/>

COURSE OUTCOMES:

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

- C01** Explain the different laws related to human environment.
C02 Describe the importance of physics in urban living.
C03 Summarize the basic concepts of energy sources.
C04 Apply the basic concepts of geothermal and hydro energy on environmental impact.
C05 Explain about the radiation protection and dosage measurements.

CO - PO MAPPING:

| | P01 | P02 | P03 | P04 | P05 | P06 | P07 | P08 | P09 | P010 | P011 | P012 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| C01 | 2 | 2 | 1 | 1 | - | - | - | - | - | - | - | - |
| C02 | 2 | 2 | 1 | 1 | - | - | - | - | - | - | - | - |
| C03 | 2 | 2 | 1 | 1 | - | - | - | - | - | - | - | - |
| C04 | 3 | 2 | 1 | 2 | - | - | - | - | - | - | - | 1 |
| C05 | 2 | 2 | 1 | 1 | - | - | - | - | - | - | - | - |

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U230E208

ENTREPRENEURSHIP DEVELOPMENT

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COURSE OBJECTIVES:

- To equip and develop the learners entrepreneurial skills and qualities essential to undertake business.
- To Gain knowledge on innovation, its types, role of technology in innovation, patents and licensing.
- To be able to prepare a business plan.

UNIT I

INTRODUCTION

9

The Entrepreneur - Definition - Characteristics of Successful entrepreneur. Entrepreneurial scene in India; MSME; Analysis of entrepreneurial growth in different communities - Case histories of successful entrepreneurs. Similarities and Differences between Entrepreneur and Intrapreneur.

UNIT II

INNOVATION IN BUSINESS

9

Types of Innovation - Creating and Identifying Opportunities for Innovation - Design Thinking- The Technological Innovation Process - Creating New Technological Innovation and Intrapreneurship - Licensing - Patent Rights - Innovation in Indian Firms.

UNIT III

NEW VENTURE CREATION

9

Identifying Opportunities for New Venture Creation: Environment Scanning - Generation of New Ideas for Products and Services. Creating, Shaping, Recognition, Seizing and Screening of Opportunities. Feasibility Analysis: Technical Feasibility of Products and Services - Marketing Feasibility: Marketing Methods - Pricing Policy and Distribution Channels.

UNIT IV

BUSINESS PLAN PREPARATION

9

Benefits of a Business Plan - Elements of the Business Plan - Developing a Business Plan - Guidelines for preparing a Business Plan - Format and Presentation; Start-ups and ecommerce Start-ups. Business Model Canvas.

UNIT V

FINANCING THE NEW VENTURE

9

Capital structure and working capital Management: Financial appraisal of new project, Role of Banks - Credit appraisal by banks. Institutional Finance to Small Industries - Incentives - Institutional Arrangement and Encouragement of Entrepreneurship.

TOTAL: 45 PERIODS

TEXT BOOKS:

- 1 R D Hisrich, "Entrepreneurship", 11th Edition, Tata McGraw Hill, 2020.
- 2 C B Gupta, "Entrepreneurship - Text and Cases", Sultan Chand & Sons, 2023.

REFERENCES:

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- 1 Desai V, "Small Scale Industries and Entrepreneurship", Himalaya Publishing House, 2018.
- 2 Bruce R Barringer, R Duane Ireland "Entrepreneurship: Successfully Launching New Ventures", 6th Edition, Pearson Education, 2018.
- 3 Roy R, "Entrepreneurship", 2nd Edition, Oxford University Press, 2011.

ONLINE RESOURCES:

- 1 <http://www.cengage.com/highered>
- 2 <https://roadmapresearch.com/entrepreneurship-beyond-curriculum>
- 3 https://onlinecourses.swayam2.ac.in/cec20_mg19/preview

COURSE OUTCOMES:

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

- C01** Explain about growth of entrepreneurship in India..
- C02** Describe about innovation, its types, role of technology in innovation, patents and licensing.
- C03** Summarize the concepts of new venture.
- C04** Design a business plan.
- C05** Comprehend the various types of financing available for new ventures.

CO - PO - PSO MAPPING:

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

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U23OE209

BASICS OF BIOENERGY AND BIOFUELS

L T P C

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COURSE OBJECTIVES:

- To introduce the concepts of biofuels and bio based products.
- To recognize the advancement of biofuels and illustrate the chemistry involved in converting them.
- To impart the knowledge about bioenergy and biofuel technology and its applications.

UNIT I INTRODUCTION 9

Bio power, Bio heat, Biofuel, advanced liquid fuels, drop-in fuels, bio based products.

UNIT II BIOMASS 9

Harvested Feed stocks: First generation biofuels, second generation biofuels, and third generation biofuels. Residue Feedstocks: Agricultural wastes, forestry wastes, farm waste, organic components of residential, commercial, institutional and industrial waste.

UNIT III PROCESSING TECHNIQUES 9

Biochemical conversion – hydrolysis, enzyme and acid hydrolysis, fermentation, anaerobic digestion and trans-esterification, Thermo chemical conversion – Combustion, Gasification, Pyrolysis

UNIT IV BIOFUELS 9

Pros and cons of Biofuels, Algal biofuels, Cyanobacteria and producers of biofuels, Bioethanol, Biomethane, biohydrogen, biobutanol, metabolic engineering of fuel molecules, Engineering aspects of biofuels.

UNIT V BIO ENERGY SUSTAINABILITY 9

Environmental Sustainability, bio energy sustainability, emissions of biomass to power generation applications, emissions from biofuels. Carbon footprint, Advanced low carbon fuels.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. R William Oswald, "Introduction to Bioenergy", Springer, 2023.
2. A K S R Reddy, "Principles and Practice", 2nd Edition , CRC Press, 2022.

REFERENCES:

1. Ashok Pandey, R C Kuhad, Vinod Kumar "Biofuels: Biochemistry and Biotechnology", 2nd Edition , Springer, 2023.
2. Anuj Kumar, R K Singh, S K Saha, "Bioenergy and Biofuels: Advanced Biorefineries for sustainable production", 1st Edition , Elsevier, 2022.

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- L David klass, M John Farewell, "Fundamentals of Bioenergy and Biofuels", 1st Edition, Academic Press (Elsevier), 2022.

ONLINE RESOURCES:

- https://onlinecourses.nptel.ac.in/noc19_bt16/preview
- <https://www.renewableinstitute.org/training/biomass-course/>
- <https://www.eesi.org/topics/bioenergy-biofuels-biomass/description>

COURSE OUTCOMES:

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

- CO1** Summarize the concept of bioenergy.
CO2 Evaluate the value of biomass.
CO3 Describe the chemistry involved in the production of bioenergy.
CO4 Explain the principle of biofuel technologies on a small and large scale.
CO5 Describe the use of biofuels in a sustainable manner.

CO – PO MAPPING:

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

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U230E210

FOOD SCIENCE

L T P C

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COURSE OBJECTIVES:

- This course will enable the students with good scientific and engineering knowledge so as to create new food products and design equipment's for food industries.
- This is necessary for effective understanding of a detailed study of food processing and technology subjects.
- This course will enable students to appreciate the importance of food with respect to the producer, manufacturer and consumer.

UNIT I FOOD PROCESS ENGINEERING OPERATIONS 9

Materials and Energy Balances - Fluid flow applications, Heat transfer applications, Drying, Evaporation, Equilibrium stage process, leaching and Extractions - Application of Mechanical separations and Mixing, in Dairy, Meat Industry, Oil and Fat Industry, Cereal processing.

UNIT II FOOD WASTES IN VARIOUS PROCESSES 9

Waste disposal-solid and liquid waste - rodent and insect control - use of pesticides - ETP - selecting and installing necessary equipment.

UNIT III FOOD PRESERVATION AND ITS IMPORTANCE 9

Introduction: Food safety and food poisoning - reasons for food poisoning and its effects. Deterioration and spoilage of processed foods - Shelf life of food products - Types of food based on its perishability. Food Preservation: Preservation methods - Thermal Methods - Pasteurization - Dehydrofreezing - Dosimetry - Transport of food and Preservation Strategies.

UNIT IV DEVELOPMENTS IN FOOD PROCESSING 9

Food Constituents and processing Food emulsions - Food Rheology, Advances in thermal Operation, Extrusion, cooking Spray dryer design - Energy expenditure and Saving Food for developing countries - Food Detoxification - Production of Sweeteners - Starch, Microbial Polysaccharides, Amino acid, Rice bran Tocopherols.

UNIT V FOOD HYGIENE AND QUALITY CONTROL 9

Quality Control in Food Industry - Dose Response Relationship, Health Problem, Chemical and Micro biological aspects - Food analysis, Instruments and Enzymatic Analysis - Food Safety. Food laws and standards.

TOTAL: 45 PERIODS

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TEXT BOOKS:

1. A David Ledford, "Food Science", 8th Edition, Springer International Publishing, 2023.
2. Owen R Fennema, Srinivasan Damodaran, "Food Chemistry", 7th Edition, CRC Press, 2022.

REFERENCES:

1. Srilakshmi B, "Food Science", 8th Edition, New Age International Publishers, 2023.
2. Sanjeev Kumar Sharma, Harshad Kiran Kalwit, "Objective Food Science", 12th Edition, Jain Brothers Publication, 2023.
3. P R Ashoh Kumar, K Suresh Babu, "Food Processing Technology: Principles and practice", 3rd Edition, CRC Press, 2022.

ONLINE RESOURCES:

- 1 <https://nptel.ac.in/courses/103107088>
- 2 <https://archive.nptel.ac.in/courses/126/105/126105015/>
- 3 https://onlinecourses.nptel.ac.in/noc21_ag01/preview

COURSE OUTCOMES:

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

- CO1** Summarize the food constituents and their energy levels.
CO2 Explain the food waste disposal in various processes.
CO3 Describe the preservative techniques to improve the shelf life of food products.
CO4 Explain the various methods of food processing and storage.
CO5 Describe the food quality control and its importance.

CO – PO MAPPING:

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

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| | | | | | |
|-----------------|--|----------|----------|----------|----------|
| U230E211 | FUNDAMENTALS OF CROP PRODUCTION | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

COURSE OBJECTIVES:

- The goal of the course is to provide knowledge about the fundamentals of agricultural production.
- Students will learn about influence of weather on crop growth, soil-water-plant relationships, disease and crop weed management.
- Outlining the function of agricultural engineers in connection to different methods of crop production

UNIT I INTRODUCTION 9

Introduction to agriculture and its crop production sub-sectors - field crop production and horticulture -Factors affecting crop growth and production. Benefits of agriculture - economic benefits, environmental benefits, social and cultural benefits, health, nutrition and food accessibility benefits.

UNIT II CROP SELECTION AND SETTLEMENT 9

Regional and seasonal selection of crops - Systems of crop production - Competition among crop plants - Spacing and arrangement of crop plants - Field preparation for crops including systems of tillage - Establishment of an adequate crop stand and ground cover, including selection and treatment of seed, and nursery growing.

UNIT III HORTICULTURAL CROPS PRODUCTION 9

Important groups of horticultural crops in Tamil Nadu such as vegetable crops, fruit crops, flower crops -Cultivation practices of representatives of each group - Special features of production of horticultural crops - green house cultivation.

UNIT IV MODERN CONCEPTS 9

Growth of plants in vertical pipes in terraces and inside buildings, micro irrigation concepts suitable for roof top gardening, rain hose system, Green house, polyhouse and shade net system of crop production on roof tops.

UNIT V AGRICULTURAL WASTE MANAGEMENT 9

Concept, scope and maintenance of waste management - recycle of organic waste, garden wastes- solid waste management - scope, microbiology of waste, other ingredients like insecticide, pesticides and fungicides residues, waste utilization.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Dr Rajendra Prasad, "Textbook of Field Crops Production Food Grains Crops", 2020.
2. Alok Kumar, Abhishek Pratap Singh, Abhishek Sonkar, Mohit Pal, Chahak Tandon, "Text Book on Production Technology of Fruit Crops" 2022.

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REFERENCES:

1. Dr Panda S C, "Modern concepts and advance principles of crop production", M/s AGROBIOS (INDIA), 2023.
2. Beena Nair, K P Singh, P Chand, "Fundamentals of Vegetable Crop Production", Scientific Publishers, 2019.
3. S R Reddy , C Nagamani, "Principles of Crop Production", Kalyani Publishers, 2019.

ONLINE RESOURCES:

1. <https://www.classcentral.com/course/youtube-agriculture-crop-production-fundamentals-bcpp-47529>
2. https://onlinecourses.nptel.ac.in/noc24_ag08/preview
3. https://onlinecourses.nptel.ac.in/noc23_ag08/preview

COURSE OUTCOMES:

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

- CO1** Summarize the principles behind crop production and various parameters that influence the crop growth on roof tops.
- CO2** Explain the methods of land preparation.
- CO3** Evaluate weed establishment and its management.
- CO4** Describe crop water requirement and irrigation water management on roof tops.
- CO5** Describe the concept of waste management on roof tops.

CO - PO MAPPING:

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

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U230E212 WATER POLLUTION AND CONTROL MANAGEMENT L T P C
3 0 0 3

COURSE OBJECTIVES:

- The goal of the course is to provide knowledge about the fundamentals of water pollution.
- To impart knowledge on the causes, effects and control or prevention measures of water pollution.
- Outlining the function of agricultural engineers in connection to different methods of water treatments.

UNIT I SOURCES OF WATER 9

Public water supply system – Planning, Objectives, Design period, Population forecasting; Water demand – Sources of water and their characteristics, Surface and Groundwater – Impounding Reservoir – Development and selection of source – Source Water quality – Characterization – Significance – Drinking Water quality standards.

UNIT II WATER POLLUTION 9

Water Pollution: Classification of Water Pollution - Pathogenic organisms, oxygen demanding Substance - plant nutrients - toxic organics, inorganic chemicals, radioactive substance – thermal pollution – steam pollution. Sources of contamination: Water borne diseases and health effects.

UNIT III PROCESSES OF WATER TREATMENT 9

Objectives – Unit operations and processes – Principles, functions, and design of water treatment plant units, aerators of flash mixers, Coagulation and flocculation - sand filters - Disinfection - Construction, Operation and Maintenance aspects.

UNIT IV ADVANCED WATER TREATMENT 9

Water softening – Desalination- R.O. Plant – demineralization – Adsorption - Ion exchange – Membrane Systems - Iron and Manganese removal - Defluoridation – Construction, Operation and Maintenance aspects.

UNIT V LAWS AND ACTS 9

Centre ground - water board and organizational set up – guidelines for water abstraction, clearance for ground water abstraction - national water policy – Tamil Nadu ground water authority and its function. River linking projects – National and International conflicts and issues. Water act 1974 and rules 1983, act 1977 and rules 1978.

TOTAL: 45 PERIODS

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TEXT BOOKS:

1. S K Gupta, I C Gupta, "Water Pollution and Quality Management", Scientific Publishers, 2023.
2. Margaret Barton, "Water Pollution: Effects, control and Treatment", 2nd Edition, Larsen and Keller Education Publishers, 2020.

REFERENCES:

1. Neha Saxena, M D Merajul Islam, Deepa Sharma, "Water Pollution and Remediation: A Global Concern", Springer, 2024.
2. G L Asawa, "Irrigation and Water Resources Engineering", New Age International Publishers, 2024.
3. O P Gupta, "Elements of Water Pollution Control Engineering", Khanna Publisher, 2019.

ONLINE RESOURCES:

1. <https://nptel.ac.in/courses/105107207>
2. <https://archive.nptel.ac.in/courses/105/104/105104102>
3. <https://archive.nptel.ac.in/courses/105/105/105105201>

COURSE OUTCOMES:

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

- CO1** Explain the sources of water and their characteristics.
CO2 Summarize the various pollutants present in water.
CO3 Describe the Principles, functions and design of a water treatment plant.
CO4 Explain the different methods of water purification process.
CO5 Describe the guidelines for water abstraction.

CO - PO MAPPING:

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

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U23OE213

PERSONALITY DEVELOPMENT

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To identify their own potentials and accept their own limitations.
- To overcome their limitations and move towards self-esteem.
- To maximize their own potential in enabling a holistic development.

UNIT I INTRODUCTION TO PERSONALITY DEVELOPMENT 9

Personality-meaning-Definition-Determinants of personality - The concept of personality - Dimensions and Significance of personality development - Becoming aware of strengths and weaknesses, talents and problems, emotions and ideas - the concept of success and failure, factors responsible for success - What is failure and causes of failure.

UNIT II ATTITUDE, MOTIVATION AND SELF - MOTIVATION 9

Attitude - Concept - Significance - Positive attitude - Advantages -Negative attitude-Disadvantages Concept of motivation - Significance - Internal and external motives - Importance of self-motivation-Factors leading to de-motivation Managing change, confusion and uncertainty Socializing the individual.

UNIT III EMPLOYABILITY QUOTIENT 9

Memory - Art of listening, learning and writing guidelines - Note making - Seminar presentation, Resume building- The art of participating in Group Discussion - Facing the Personal (HR & Technical) Interview -Frequently Asked Questions - Psychometric Analysis - Mock Interview Sessions.

UNIT IV ASPECTS OF PERSONALITY DEVELOPMENT 9

Body language - Problem-solving - Conflict and Stress Management - Decision-making skills - Leadership and qualities of a successful leader - Character building -Team-work - Time management - Work ethics -Good manners and etiquette.

UNIT V INTEGRATED PERSONALITY DEVELOPMENT 9

Different dimension personality - Physical, Intellectual, Emotional, Moral, Social and Spiritual and Cultural - Learning the Development process - Tools and Skills - Helping to maximize one's potentials - Enhancing one's self image, self-esteem and self- confidence.

TOTAL: 45 PERIODS

TEXT BOOKS:

- 1 Ark, "Personality Development and Character Building" Finger print Publishing, 2024.
- 2 Prashant Sharma, "Soft Skills: Personality Development for Life Success", 1st Edition, BPB Publications, 2022.

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REFERENCES:

- 1 Soma Mahesh Kumar, "Soft Skills: Enhancing Personal and Professional Success" 1st Edition, Tata McGraw Hill, 2023.
- 2 Sabharwal. D P, "Personality Development", Finger print Publishing, 2021.
- 3 Jeff Butterfield, "Soft Skills for Everyone", 2nd Edition, Cengage India Private Limited 2020.

ONLINE RESOURCES:

- 1 https://onlinecourses.nptel.ac.in/noc22_hs77/preview
- 2 <https://old.podcast.com/best-free-ebooks-personal-development>
- 3 <https://www.sircicai.org/images/cabf/Soft%20Skills%20&%20Personality%20Development.pdf>

COURSE OUTCOMES:

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

- CO1** Describe the significance of personality and its development.
CO2 Analyze the different facets of personality development.
CO3 Apply employability skills of resume, job application and presentation.
CO4 Apply the aspects of personality development in their jobs.
CO5 Apply the technique and skills of personality development to improve their progress.

CO - PO MAPPING:

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

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U230E214 **WORKPLACE COMMUNICATION** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To develop in students the competence to select the appropriate language and strategies for effective communication in daily workplace contexts.
- To View real-world facets of challenges faced when communicating in the workplace.
- To Learn how to work in different business environments.

UNIT I IDENTIFY WORKPLACE PERSONALITIES 9

Communication process; Analysis of purpose, audience, information and context; Strategies for verbal and nonverbal communication; Selection of communication channels - How communication should be developed, assignment - Studying types of personalities.

UNIT II NEW MEDIA IN COMMUNICATION 9

Impact of Technology, Enabled Communication Types: Internet, Blogs, E-mail; social media - Facebook, Twitter and What's App -Advantages & Disadvantages.

UNIT III WORKPLACE CORRESPONDENCE 9

Business Letter Writing, Email Writing, Principles of Effective Letter Writing, Email Writing, Four C's of Communication – Correctness, Completeness, Conciseness, Courtesy Parts of a Business Letter, Letter of Recommendation, Letter of Appointment, Letter of Acceptance of Job Offer, Letter of Appreciation, & Letter of Resignation.

UNIT IV COMMUNICATION AT THE WORKPLACE 9

Education and Training, Motivation, Persuasion, Raising Morale, Order and Instruction, Warning, Advice, Business Etiquette Office Etiquette, Internet Etiquette/Netiquette, Business Card Etiquette, Handshake Etiquette, Mobile Phone Etiquette and How to Overcome Them.

UNIT V WORKPLACE CHALLENGES 9

Working With Others : Leaders And Followers; Managing Your Emotions : Negative Emotions ; Challenging Conversations : Challenging Opposing Views, Sharing Bad News, Dealing With An Angry Customer Or Colleague; Personal Development Planning, Presentations; Telephone Skills; Job Interviews. Group Communication, Planning And Decision Making.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Tena Crews, Cara Norton, "Professional Communication", Good heart-Willcox Publisher, 2023.
2. Jeanne Marquardt Elmhorst Ronald B. Adler, Jeanne Marquardt Elmhorst "ISE Communicating at Work", Tata McGraw Hill, 2022.

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REFERENCES:

1. Bovee, L Courtland, Thill, V John , Raina, Lal Rosha, "Business Communication Today" 15th Edition, Pearson Education, 2021.
2. James W Williams, communication Skills Training Series", Alakai Publishing, 2021.
3. McKinsey Company "Building workforce skills at scale to thrive during and after the COVID-19 crisis." 2021.

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc20_hs15/preview
2. <https://www.coursera.org/learn/challenges-of-leading-individuals-in-the-tech-industry>
3. <https://www.udemy.com/course/business-english-writing/>

COURSE OUTCOMES:

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

- CO1** Apply The Basic Knowledge Of Workplace Communication.
CO2 Apply Different Types Of Media Communication.
CO3 Write Effective Letters Related To Workplace Environment.
CO4 Apply Various Types Of Workplace Etiquette.
CO5 Explain The Strategies Of Overcoming Challenges In The Workplace.

CO - PO MAPPING:

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

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U230E215

ENGLISH FOR COMPETITIVE EXAMINATIONS

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To train the students in the language components essential to face competitive examinations both at the national (UPSC, Banking, Railway, Defence) and the international level (GRE, TOEFL, IELTS).
- To enhance an awareness of the specific patterns in language testing and the respective skills to tackle verbal reasoning and verbal ability tests.
- To inculcate effective practices in language-learning in order to improve accuracy in usage of grammar and coherence in writing.

UNIT I BASIC VOCABULARY 9

Orientation on different formats of competitive exams - Vocabulary - Verbal ability - Verbal reasoning - Exploring the world of words - Essential words - Meaning and their usage - Synonyms-antonyms - Word substitution - Word analogy - Idioms and phrases - Commonly confused words - Spellings - Word expansion - New words in use.

UNIT II GRAMMAR AND USAGE 9

Grammar - Sentence improvement - Sentence completion - Rearranging phrases into sentences - Error identification - Tenses - Prepositions - Adjectives - Adverbs - Subject-verb agreement - Voice - Reported speech - Articles - Clauses - Speech patterns.

UNIT III EFFECTIVE READING 9

Reading - Specific information and detail - Identifying main and supporting ideas - Speed reading techniques - Improving global reading skills - Linking ideas - Summarising - Understanding argument - Identifying opinion/attitude and making inferences - Critical reading.

UNIT IV WRITING VARIOUS TEXT 9

Writing - Pre-writing techniques - Mind Map - Describing pictures and facts - Paragraph structure - organizing points - Rhetoric writing - Improving an answer - Drafting, writing and developing an argument - Focus on cohesion - Using cohesive devices - Analytic writing - Structure and types of essay - Mind maps - Structure of drafts, letters, memos, emails - Statements of Purpose - Structure, Content and Style.

UNIT V INTERACTIVE LISTENING 9

Listening and Speaking - Contextual listening - Listening to instructions - Listening for specific information - Identifying detail, main ideas - Following signpost words - Stress, rhythm and intonation - Speaking to respond and elicit ideas - Guided speaking - Opening phrases - Interactive communication - Sentence stress - Speaking on a topic - Giving opinions - Giving an oral presentation - Telling a story or a personal anecdote - Talking about oneself - Utterance - Speech acts - Brainstorming ideas - Group discussion.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Dr. Veena Selvam, "English for Science and Technology", Cambridge University Press, 2021.
2. Wren, Martin, "English for Competitive Examinations", S Chand Publishing, 2020.

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REFERENCES:

1. Bovee, Courtland L, Thill, John V Raina, Lal Roshan, "Business Communication Today", 15th Edition, Pearson Education: Upper Saddle River, 2021.
2. Disha, " General English for Competitive Exams" Disha Publication, 2021.
3. Yashpal,Sharma, "Easy to learn General English" Agrawal Group Of Publications (Agrawal Examcart), 2020.

ONLINE RESOURCES:

1. <http://www.examenglish.com/>, <http://www.ets.org/>, <http://www.bankxams.com/>
2. <http://civilservicesmentor.com/>, <http://www.educationobserver.com>
3. <http://www.cambridgeenglish.org/in/>

COURSE OUTCOMES:

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

- C01** Apply the intricacies of vocabulary in order to develop language skills.
C02 Analyze the technique of grammar to face competitive examination
C03 Apply the basic ideas and strategies of reading.
C04 Write different types of reconstructing passages, report writing and essay writing.
C05 Apply interactive communication skills in listening texts.

CO - PO MAPPING:

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

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U230E216

ENGLISH FOR PROFESSIONAL EXCELLENCE

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To enhance students' ability to listen and speak professionally related to workplace concerns and interactions.
- To improve articulation and comprehension through motivational texts, technical articles, and leadership talks.
- To enable students to write reviews, emails, reports, resumes with cover letters and projects.

UNIT I FOUNDATIONS OF PROFESSIONAL COMMUNICATION 9

Listening to concerns and complaints – Responding with thought-provoking solutions – Reading short motivational anecdotes to improve pronunciation – Writing paragraphs based on motivational ideas and proverbial expressions.

UNIT II EXPRESSIVE AND PERSUASIVE COMMUNICATION 9

Listening to famous motivational speeches – Practice short speeches like welcome address, vote of thanks and farewell address – Reading technical articles with intonation - Writing reviews and reflections on travel, books or current topics.

UNIT III WORKPLACE COMMUNICATION AND ETIQUETTE 9

Listening workplace conversations and discussions – Simulate meetings and practice giving polite instructions– Reading workplace memos and notices – Writing professional emails and reports.

UNIT IV COMMUNICATION FOR COLLABORATION AND LEADERSHIP 9

Listening to interview recordings and career talks – Practice introducing yourself and mock interviews – Reading job postings – Drafting resumes and cover letter.

UNIT V CAREER COMMUNICATION AND PERSONAL BRANDING 9

Listening to panel discussions – Practice group discussions – Reading leadership talks – Project writing and formal presentation.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Rajendran, Jayanthi, Jeya Santhi V, Nagalakshmi B, "The Art of English Communication: A Practical Approach", <https://notionpress.com>, 2025.
2. Horine, Greg, "Project Management Absolute Beginner's Guide" (Updated Edition), Que Publishing, 2023.

REFERENCES:

1. Bryan A. Garner, "HBR Guide to Better Business Writing", Harvard Business Review Press, 2021.
2. Nair, Bhaskaran, P. "Functioning in English" (A Multi-skill Language Course for Undergraduate Programmes), Emerald Publishers, 2018.
3. Enelow, Wendy, Louise Kursmark, "Modernize Your Resume: Get Noticed... Get Hired" (3rd Edition), Emerald Career Publishing, 2023.

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ONLINE RESOURCES:

1. <https://reedsy.com/discovery/blog/book-review-examples>
2. <https://www.indeed.com › Career Guide › Interviewing>
3. <https://nevonprojects.com/project-ideas/>

COURSE OUTCOMES:

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

- C01 Apply listening and reading skills to enhance clarity in writing.
- C02 Analyze and internalize motivational speech techniques to develop their oral and written communication proficiency.
- C03 Apply professional communication strategies and compose effective emails and reports.
- C04 Analyze career-oriented communication and draft resumes and cover letter.
- C05 Design engaging formats to present their prepared projects.

CO - PO MAPPING:

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

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| | | | | | |
|-----------------|--|----------|----------|----------|----------|
| U23OE217 | TOOLS FOR COMPUTING AND DESIGN PLATFORM | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

COURSE OBJECTIVES:

- Understand the basics of electronic circuit assembly, ARM, DSP and embedded processors.
- Study about the Xilinx ISE design suite for programming and simulation of HDL designs and the implementation of VHDL and simulation using Altera Quartus.
- Understand the role of cloud in the design development of IC and IOT based embedded system.

UNIT I **TINKERCAD** **9**

Create a breadboard circuit, Circuit build, Virtual circuit design, programming, simulation, Arduino electronic circuits, Programme your Arduino, Test your Arduino circuit and code, 3D Design

UNIT II **XILINX ISE DESIGN SUITE** **9**

Synthesis and analysis of HDL designs, enabling the developer to synthesize ("compile") their designs, perform timing analysis, examine RTL diagrams, simulation, Spartan family of FPGAs, CPLDs.

UNIT III **CODE COMPOSER STUDIO IDE** **9**

Implementation of VHDL and Verilog for hardware description, visual edition of logic circuits and vector waveform simulation. Cyclone family of FPGAs, MAX family of CPLDs.

UNIT IV **GSM AND 3G COMMUNICATIONS SYSTEMS** **9**

IDE for developing applications for Texas Instruments embedded processors. Texas Instruments embedded processors include DSPs, ARM based devices, MSP430.

UNIT V **ROLE OF THE CLOUDS IN ELECTRONIC DESIGN** **9**

History of high-performance computing, Cloud service model basics - user's interest, service type, service providers, Cloud concerns, Pros and Cons with electronics design - on-premises, all cloud, Hybrid cloud, Cadence Cloud in IC design.

TOTAL: 45 PERIODS

TEXT BOOKS:

- 1 Shaun C. Bryant, "Tinkercad For Dummies", John Wiley & Sons, 2018.
- 2 Michael J Kavis, "Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS)", John Wiley & Sons, 2014.

REFERENCES:

- 1 ISE In-Depth Tutorial, https://www.xilinx.com/support/documentation/sw_manuals/xilinx13_3/ise_tutorial_ug695.pdf

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- 2 Code-Composer-Studio-v6.0-for-MSP430-Users-Guide, <https://www.ti.com/lit/ug/slau157as/slau157as.pdf?ts=1707371916957>
- 3 Introduction to Quartus II Software, [http://www.ee.ic.ac.uk/cheung/teaching/ee2_digital/R2_3%20quartus 2 introduction.pdf](http://www.ee.ic.ac.uk/cheung/teaching/ee2_digital/R2_3%20quartus%20introduction.pdf).

ONLINE RESOURCES:

- 1 <https://archive.nptel.ac.in/courses/117/108/117108040/>
- 2 <https://www.tinkercad.com/learn>
- 3 <https://elearn.nptel.ac.in/shop/iit-workshops/completed/digital-controller-for-power-applications/>

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

- CO1** Analyze the fundamentals electronic circuit build, Arduino board programming and simulation.
- CO2** Describe the concepts of HDL design, Spartan family of FPGA and CPLD.
- CO3** Analyze VHDL and Verilog programming.
- CO4** Analyze the IDE for the Texas Instruments processors, ARM and embedded processors.
- CO5** Describe the latest evolution cloud in the development of IOT based embedded system.

CO - PO - PSO MAPPING:

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

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| | | | | | |
|-----------------|--|----------|----------|----------|----------|
| U230E218 | INTRODUCTION TO SENSORS AND ACTUATORS | L | T | P | C |
| | | 3 | 0 | 0 | 3 |

COURSE OBJECTIVES:

- To study different types of sensors and actuators.
- To gain knowledge on type of optical sensors to be used for practical applications.
- To understand the design concepts of micro sensors and micro actuators and packaging and characterization of MEMS/NEMS.

UNIT I STRAIN, PRESSURE AND TEMPERATURE 9

Introduction, Stress & Pressure sensors: Resistance strain gauge, piezoelectric strain gauge, characteristics. Fiber-optic sensor, Pressure gauges. Temperature Sensors: Bimetallic strip, thermocouples, Resistance thermometers, thermistors, bolometer, Pyroelectric detector.

UNIT II OPTICAL SENSORS 9

Colour temperature, light flux, photo sensors, photomultiplier, photo resistor and photoconductors, photodiodes, phototransistors, photovoltaic devices, fiber optic sensors, electro optic sensors & fiber-optic applications, light transducer, solid-state transducers and liquid crystal devices.

UNIT III MICRO SENSORS 9

Acoustic sensor – Quartz crystal microbalance, surface acoustic wave, Flexural plate wave, shear horizontal; Vibratory gyroscope, Capacitive and Piezo Resistive Pressure sensors.

UNIT IV MICRO ACTUATORS 9

Electrostatic actuators – parallel plate capacitor, Interdigitated finger capacitor, piezoelectric actuators, Thermal actuators, Actuators using shape memory alloys; Micro grippers, Micro motors, Micro valves, Micro pumps

UNIT V PACKAGING AND CHARACTERIZATION 9

Micro / nano systems packaging, Essential packaging technologies, Selection of packaging materials; SEM, TEM, AFM, STM, Spectroscopic techniques for Nano characterization.

TOTAL: 45 PERIODS

TEXT BOOKS:

- 1 Tai Ran Hsu, "MEMS and Microsystems Design and Manufacture", 1st Edition, Tata McGraw Hill, 2002.
- 2 Ian R Sinclair, "Sensors and Transducers", 3rd Edition, Newnes publishers, 2001.

REFERENCES:

- 1 Vinod Kumar Khanna, "Nanosensors: Physical, Chemical, and Biological", 1st Edition, CRC Press, 2012.

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- 2 Doebelin E O, "Measurement Systems, Application and Design", 5th Edition, Tata McGraw Hill, 2004.
- 3 Chang Liu, "Foundations of MEMS", 2nd Edition, Pearson Education, 2006.

ONLINE RESOURCES:

- 1 https://onlinecourses.nptel.ac.in/noc21_ee32/preview
- 2 <https://www.udemy.com/course/exploring-sensors-and-actuators-theory-and-practice/>
- 3 <https://www.coursera.org/learn/internet-of-things-sensing-actuation>

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

- CO1** Explain the measurement of physical variables for real time applications using sensors.
- CO2** Analyse optical sensors for electronic applications.
- CO3** Analyse micro sensors for electronic applications.
- CO4** Apply actuators for engineering applications.
- CO5** Describe the packaging and characterization requirements.

CO - PO - PSO MAPPING:

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

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U23OE219

UNDERWATER COMMUNICATION

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To understand the properties of underwater acoustic signal and the characteristics of noises in sea.
- To understand the principles of SONAR and acoustic modem.
- To understand the challenges in underwater signal processing and sensor networks.

UNIT I FUNDAMENTALS OF UNDERWATER ACOUSTICS 9

The Ocean acoustic environment, measuring sound level, Sources and receivers, relevant units, sound velocity in sea water, typical vertical profiles of sound velocity, Sound propagation in the Ocean, Sound attenuation in sea water, Bottom Loss, Surface bottom and volume scattering, Snell's law for range dependent ocean.

UNIT II UNDERWATER NOISE IN THE SEA 9

Sources of ambient noise-introduction, different frequency bands of ambient noise, spatial Coherence of underwater noise, directional characteristics of underwater noise, intermittent sources of noise – biological & non biological (rain, earthquakes, explosions and volcanos).

UNIT III CHARACTERISTICS OF SONAR SYSTEMS 9

Sonar systems, active and passive sonar equations, transducers and their directivities, Sensor, array characteristics – array gain, receiving directivity index, beam patterns, adaptive beamforming.

UNIT IV ACOUSTIC MODEM 9

Underwater Wireless Modem- Sweep spread carrier signal – transmission characteristics in shallow water channel-separation of time varying multipath arrivals – Typical acoustics modems – characteristics and specifications – Applications, Acoustic Releases-Real time wireless current monitoring system.

UNIT V UNDERWATER SENSOR NETWORK 9

Underwater Networking – Ocean Sampling Networks, Pollution Monitoring, Environmental Monitoring and Tactical surveillance systems, Major challenges in the design of Underwater Sensor Networks, Factors that affect the UWSN.

TOTAL: 45 PERIODS

TEXT BOOKS:

- 1 Yi Lou, Niya Ahmed, "Underwater Communications and Networks", 1st Edition, Springer, 2021.
- 2 William S Burdic, "Underwater Acoustic Systems", Prentice Hall of India, 2002.

REFERENCES:

- 1 Rahul Sharma, "Deep Sea Mining Handbook", 1st Edition, Springer, 2017

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- 2 Robert J Urick, "Principles of Underwater Sound", 3rd Edition, Peninsula Publishing, 2013.
- 3 L M Brekhovskikh, Yu P Lysanov, "Fundamentals of ocean acoustics", 3rd Edition, Springer, 2003

ONLINE RESOURCES:

- 1 <https://www.everand.com/book/324344346/Digital-Underwater-Acoustic-Communications>
- 2 <https://edfuturetech.com/courses/from-sonar-to-satellite-a-deep-dive-into-underwater-communication-systems-and-their-uses/>
- 3 <https://www.youtube.com/watch?v=VExBwR2Gs24>

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

- CO1** Summarize the properties of underwater acoustic signal.
- CO2** Explain the characteristics of noises in sea.
- CO3** Explain the principles of SONAR and acoustic modem.
- CO4** Explain the concepts of adaptive modem.
- CO5** Analyse the challenges in underwater signal processing and sensor networks.

CO - PO - PSO MAPPING:

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

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U23OE220

CONSUMER ELECTRONICS

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To Understand the fundamental concepts of consumer electronics.
- To Learn the basics and operations of home appliances.
- To learn the operation of various audio, video & recording systems.

UNIT I CONSUMER ELECTRONICS FUNDAMENTALS 9

History of Electronic Devices, Semiconductor Devices, Diodes, Rectifiers, Transistors, Integrated Circuits, Logic Gates, Combinational Circuits, ADC, DAC and Microprocessors, Microcontrollers in consumer electronics, Energy management, Intelligent Building Perspective.

UNIT II ENTERTAINMENT ELECTRONICS 9

Audio systems – Construction and working principle of Microphone, Loud speaker, AM and FM receiver, Stereo, 2.1 home theatre, 5.1 home theatre, Display systems – CRT, LCD, LED, Graphics displays, Video Players, DVD, Blue RAY Recording Systems – Digital Cameras and Camcorders.

UNIT III SMART HOME 9

Technology involved in Smart home, Home Virtual Assistants – Alexa and Google Home, Home Security Systems – Intruder Detection, Automated blinds, Motion Sensors, Thermal Sensors and Image Sensors, PIR, IR and Water Level Sensors.

UNIT IV HOME APPLIANCES 9

Home Enablement Systems – RFID Home, Lighting control, Automatic Cleaning Robots, Washing Machines, Microwave Oven, Dishwasher, Induction Stoves, Smart Refrigerators, Smart alarms, Smart toilet, Smart floor, Smart locks.

UNIT V COMMUNICATION SYSTEMS 9

Cordless Telephones, Fax Machines, PDAs – Tablets, Smart Phones and Smart Watches, Introduction to Smart OS-Android and iOS, Video Conferencing Systems – Web/IP Camera, Video security, Internet Enabled Systems, Wi-Fi, IoT, Li-Fi, GPS and Tracking Systems.

TOTAL: 45 PERIODS

TEXT BOOKS:

- 1 Mitchel E Schultz, "Basic Electronics", McGraw Hill Publishers, 10th Edition, 2017.
- 2 Bali S P, "Consumer Electronics", Pearson Education Asia Pvt. Ltd., 2008.

REFERENCES:

- 1 Thomas L Floyd, "Electronic Devices", 10th Edition Pearson Education, 2018.
- 2 Thomas M Coughlin, "Digital Storage in Consumer Electronics", Springer, 2017.
- 3 Jordan Frith, "Smartphones as Locative Media", John Wiley & Sons, 2014.

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ONLINE RESOURCES:

- 1 <https://www.edx.org/learn/electronics>
- 2 <https://www.coursera.org/learn/electronics>
- 3 <https://archive.nptel.ac.in/courses/117/105/117105144>

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

- C01** Apply the fundamentals of electronics to construct the audio and video systems.
- C02** Explain working of various colour television system.
- C03** Analyze the technology for smart home.
- C04** Describe the working principles of various home appliances.
- C05** Describe the basic functional blocks of home based communication systems.

CO - PO - PSO MAPPING:

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

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U230E221

BASICS OF EMBEDDED SYSTEMS AND IOT

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COURSE OBJECTIVES:

- Understand the concepts of embedded system design and analysis
- Learn the architecture and programming of ARM processor.
- Learn the concepts of IoT and embedded programming.

UNIT I

INTRODUCTION TO EMBEDDED SYSTEM

9

Complex systems and microprocessors- Embedded system design process - Design methodologies - Design flows - Requirement Analysis - Specifications-System analysis and architecture design - Quality Assurance techniques-Design example: Model train controller.

UNIT II

BASICS OF ARM ARCHITECTURE AND PERIPHERAL INTERFACING

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 M3 MCU

UNIT III

EMBEDDED PROGRAMMING CONCEPTS

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

INTRODUCTION TO IoT

9

Functional blocks of an IoT system - Basics of Physical and logical design of IoT - IoT enabled domains - Difference between IoT - Passive and active sensors - Different applications of sensors - IoT front-end hardware Case Studies - Smart Parking, Air Pollution Monitoring.

UNIT V

COMMUNICATION PROTOCOLS FOR EMBEDDED AND IoT

9

Embedded Networking: Introduction-Serial/Parallel Communication - Serial communication protocols - RS485 - Synchronous Serial Protocols - Serial Peripheral Interface (SPI) - Inter-Integrated Circuit (I2C), IoT Infrastructure - 6LowPAN - IPv6 - Wi-Fi, Bluetooth, ZigBee.

TOTAL: 45 PERIODS

TEXT BOOKS:

- 1 Arshdeep Bahga, Vijay Madiseti, "Internet of Things, A Hands-on-Approach", 1st Edition, Universities Press Pvt. Ltd., India, 2015.
- 2 Marilyn Wolf, "Computers as Components - Principles of Embedded Computing System Design", 3rd Edition, Morgan Kaufmann Publisher (An imprint from Elsevier), 2012.

REFERENCES:

- 1 Adrian McEwen and Hakim Cassimally, "Designing the Internet of Things", 1st Edition, John Wiley & Sons, 2014.
- 2 Peter Waher, "Learning Internet of Things", 1st Edition, Packt Publishing Ltd., UK, 2015.

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- 3 Raj Kamal, "Internet of Things, Architecture and Design Principles", Tata McGraw Hill, 2017.

ONLINE RESOURCES:

- 1 <https://nptel.ac.in/courses/108102045>
- 2 <https://www.udemy.com/course/embedded-system-for-internet-of-things-pna/>
- 3 <https://www.coursera.org/learn/iot>

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

- CO1** Explain the embedded System Design Process.
- CO2** Describe the architecture and programming of ARM processor.
- CO3** Explain the concepts of embedded system programming
- CO4** Explain the basic concepts of IOT.
- CO5** Describe model networked systems with basic protocols

CO - PO - PSO MAPPING:

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| CO1 | 3 | 2 | 2 | 3 | 1 | 3 | - | - | - | - | - | 1 |
| CO2 | 3 | 2 | 2 | 3 | 2 | 3 | - | - | - | - | - | 1 |
| CO3 | 3 | 2 | 2 | 3 | 2 | 3 | - | - | - | - | - | 1 |
| CO4 | 3 | 2 | 2 | 3 | 2 | 3 | - | - | - | - | - | 1 |
| CO5 | 3 | 2 | 2 | 3 | 2 | 3 | - | - | - | - | - | 1 |

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U23OE222

INDUSTRIAL SAFETY

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COURSE OBJECTIVES:

- To Understand the Introduction and basic Terminologies safety.
- To provide wide exposure to the students about various legislation applicable to an industrial unit .
- To enable students to Conduct and participate in various Safety activities in the Industry and through various Risk Assessment Techniques.

UNIT I SAFETY TERMINOLOGIES 9

Hazard-Types of Hazard- Risk-Hierarchy of Hazards Control Measures-Lead indicators- lag Indicators-Flammability- Toxicity Time-weighted Average (TWA) - Threshold Limit Value (TLV) - Short Term Exposure Limit (STEL)- Immediately dangerous to life or health (IDLH)- acute and chronic Effects- Routes of Chemical Entry-Personnel Protective Equipment- Health and Safety Policy-Material Safety Data Sheet MSDS

UNIT II STANDARDS AND REGULATIONS 9

FACTORIES ACT - 1948

Statutory authorities - inspecting staff, health, safety, provisions relating to hazardous processes, welfare - special provisions - penalties and procedures- Tamil Nadu Factories Rules 1950 under Safety and health chapters of Factories Act 1948 - Tamil Nadu safety officer rules 2005.

ENVIRONMENT ACT - 1986

General powers of the central government, prevention, control and abatement of environmental pollution Biomedical waste (Management and handling Rules), 1989- The noise pollution (Regulation and control) Rules, 2000- The Batteries (Management and Handling Rules)

UNIT III OTHER ACTS AND RULES 9

Indian Boiler (Amendments) Act 2007, static and mobile pressure vessel rules (SMPV), motor vehicle rules, the Mines and Minerals (Development & Regulation) Amendment Act, 2015, workman compensation act, rules - electricity act and rules - hazardous wastes (management, handling and transboundary) rules, 2008 - the building and other construction workers act 1996., Petroleum rules, Gas cylinder rules 2016, Explosives Act 1884 - Pesticides Act - E waste (management) rules 2016.

UNIT IV SAFETY ACTIVITIES 9

Toolbox Talk- Role of safety Committee- Responsibilities of Safety Officers and Safety Representatives- Safety Training and Safety Incentives- Mock Drills- On-site

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Emergency Action Plan- Off-site Emergency Action Plan- Safety poster and Display- Human Error Assessment

UNIT V HAZARD IDENTIFICATION TECHNIQUES 9

Job Safety Analysis-Preliminary Hazard Analysis-Failure mode and Effects Analysis-Hazard and Operability- Fault Tree Analysis- Event Tree Analysis Qualitative and Quantitative Risk Assessment- Checklist Analysis- Root cause analysis- What-If Analysis- and Hazard Identification and Risk Assessment

TOTAL: 45 PERIODS

REFERENCES:

- 1 Frank P Lees, "Loss Prevention in Process Industries", 4th Edition, Butterworth Heinemann Publications, 2012.
- 2 John Ridley, John Channing, "Safety at Work", 7th Edition, BH Publications, 2008.
- 3 Dan Petersen, "Techniques of Safety Management: A System Approach", 4th Edition, Amer Society of Safety Engineers, 2003.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

- CO1** Explain the basic concept of safety.
- CO2** Summarize important legislation related to health, Safety and Environment.
- CO3** Explain various legislation applicable to an industrial unit
- CO4** Describe the safety Activities of the Working Place and to prepare onsite and offsite emergency plans
- CO5** Explain the Risk Assessment Techniques

CO - PO MAPPING:

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

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|-----------------|--------------------------------------|----------|----------|----------|----------|
| U230E223 | RENEWABLE ENERGY TECHNOLOGIES | L | T | P | C |
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COURSE OBJECTIVES:

- To learn the various solar energy and Wind technologies and its applications.
- To explore the various biomass energy technologies and fuel cell.
- To study the ocean and geothermal technologies.

UNIT I ENERGY SCENARIO 9
 Control System: Open Loop and Closed Loop – Feedback Control System Characteristics – First Principle Modeling: Mechanical, Electrical and Electromechanical Systems – Transfer Function Representations: Block Diagram and Signal Flow Graph.

UNIT II SOLAR ENERGY 9
 Solar Thermal – Flat Plate and Concentrating Collectors – Solar Thermal Power Plant – Solar Photovoltaic Conversion – Solar Cells – PV Applications.

UNIT III WIND ENERGY 9
 Basic Components of Wind Energy Conversion System (WECS) - Classification Of WECS - Horizontal Axis - Single, Double And Multi-Blade System. Vertical Axis - Savonius and Darrieus Types.

UNIT IV BIOMASS ENERGY AND FUEL CELL 9
 Biomass Direct Combustion – Biomass Gasifier – Biogas Plant – Cogeneration – Biomass Applications - Fuel Cell.

UNIT V OCEAN AND GEOTHERMAL ENERGY 9
 Tidal Energy – Wave Energy – Open and Closed OTEC Cycles – Small Hydro – Geothermal Energy - Types of Geothermal Power Plants.

TOTAL: 45 PERIODS

REFERENCES

1. John Twidell, “Renewable Energy Resources”, 4th Edition, Routledge Publishers, 2021.
2. Bent Sorensen, “Renewable Energy: Physics, Engineering, Environmental Impacts, Economics and Planning”, 5th Edition, Academic Press, 2017.
3. Godfrey Boyle, “Renewable Energy: Power for a Sustainable Future”, 3rd Edition, Oxford University Press, 2012.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

- CO1** Explain the Environmental aspects of energy utilization and Renewable energy scenario.
- CO2** Describe the concepts and applications of solar energy systems.
- CO3** Describe the concepts and applications of wind energy systems.

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- CO4** Summarize the processes of biomass and Fuel Cell.
CO5 Explain on other possible renewable energy sources.

CO - PO MAPPING:

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

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U230E224

INTRODUCTION TO SMART GRID

L T P C

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COURSE OBJECTIVES:

- To know the power industry to observe and control parts of the system at higher resolution in time and space
- To purposes of the smart grid is real time information exchange to make operation as efficient as possible
- To know how to improve reliability of the Electricity networks and make the grid amenable to renewable energy inputs through distributed generation.

UNIT I INTRODUCTION TO SMART GRID 9

Evolution of Electric Grid – Concept - Definitions and Need for Smart Grid- Smart grid drivers - functions - opportunities - challenges and benefits- Difference between conventional & Smart Grid- National and International Initiatives in Smart Grid.

UNIT II SMART GRID TECHNOLOGIES 9

Technology Drivers - Smart energy resources- Smart substations - Substation Automation - Feeder Automation -Transmission systems: EMS - FACTS and HVDC - Wide area monitoring- Protection and control- Distribution systems: DMS- Volt/VAR control- Fault Detection- Isolation and service restoration-

UNIT III SMART METERS AND ADVANCED METERING INFRASTRUCTURE 9

Introduction to Smart Meters- Advanced Metering infrastructure (AMI) drivers and benefitsAMI protocols- standards and initiatives- AMI needs in the smart grid- Phasor Measurement Unit (PMU)- Intelligent Electronic Devices(IED)& their application for monitoring & protection.

UNIT IV POWER QUALITY MANAGEMENT IN SMART GRID 9

Power Quality & EMC in Smart Grid- Power Quality issues of Grid connected Renewable Energy Sources- Power Quality Conditioners for Smart Grid- Web based Power Quality monitoring- Power Quality Audit.

UNIT V CONTROLLERS AND THEIR COORDINATION 9

Introduction and role of SCADA in smart grid - Local Area Network (LAN) - House Area Network (HAN) - Wide Area Network (WAN) - Broad band over Power line (BPL) - IP based Protocols- Basics of Web Service, CLOUD Computing - and Cyber Security Issues.

TOTAL: 45 PERIODS

REFERENCES:

1. Stuart Borlase, "Smart Grid: Infrastructure, Technology and Solutions", 1st Edition, CRC Press, 2017.
2. James A Momoh, "Smart Grid: Fundamentals of Design and Analysis", 1st Edition, John Wiley & Sons, 2012.

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3. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", 1st Edition, John Wiley & Sons, 2012.

COURSE OUTCOMES:


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

- CO1** Explain the concepts of Smart Grid and its present developments.
CO2 Describe about the different smart grid technologies.
CO3 Explain about the different smart meters and apply them in advanced metering infrastructure.
CO4 Analyze power quality management in smart grid.
CO5 Summarize LAN, WAN and cloud computing for smart grid.

CO - PO MAPPING:

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

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U230E225

BASICS OF POWER PLANT ENGINEERING

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COURSE OBJECTIVES:

- To provide knowledge on the operation of thermal power plant and the subsystems including fuel Preparation and handling, boiler types.
- To impart knowledge on layout and operation of diesel and gas turbine power plants and nuclear power plants.
- To educate the environmental and cost economics of using renewable energy sources compared to fossil fuels and to introduce the importance of instrumentation, measurement and control techniques in power plants.

UNIT I COAL BASED THERMAL POWER PLANTS 9

Layout of modern coal power plant, Supercritical Boilers, FBC Boilers, Turbines, Condensers, Steam & Heat rate, Subsystems of thermal power plants – Fuel and ash handling, Draught system, Feed water treatment.

UNIT II DIESEL, GAS TURBINE AND COMBINED CYCLE POWER PLANTS 9

Otto, Diesel, Dual & Brayton Cycle – Analysis & Optimization. Components of Diesel and Gas Turbine power plants.

UNIT III NUCLEAR POWER PLANTS 9

Basics of Nuclear Engineering, Layout and subsystems of Nuclear Power Plants, Working of Nuclear Reactors : Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), CANada Deuterium – Uranium reactor (CANDU), Safety measures for Nuclear Power plants.

UNIT IV ENERGY, ECONOMIC AND ENVIRONMENTAL ISSUES OF POWER PLANTS 9

Power tariff types, Load distribution parameters, load curve, Comparison of site selection criteria, relative merits & demerits, Capital & Operating Cost of different power plants.

UNIT V POWER PLANT INSTRUMENTATION AND CONTROL 9

Plant Automation, Plant Optimization, Safety & Protection, Instrumentation & Controls. Importance of measurement and instrumentation in power plants, measurement of water purity, CO₂ measurements, measurement of smoke and dust.

TOTAL: 45 PERIODS

REFERENCES:

- 1 P K Nag, "Power Plant Engineering", 4th Edition, Tata McGraw Hill, 2020.
- 2 M M El Wakil, "Power Plant Technology", 3rd Edition, Tata McGraw Hill, 2021.



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- 3 Arora, Domkundwar, "A Course in Power Plant Engineering", 3rd Edition, Dhanpat Rai & Co, 2019.
- 4 R S Khurmi, J K Gupta, "Thermal Engineering", 3rd Edition, S Chand Publishing, 2021.

COURSE OUTCOMES:

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

- C01** Comprehend the layout, construction and working of the components inside a thermal power plant.
- C02** Summarize the process of diesel, gas turbine and combined cycle power plants.
- C03** Explain the different nuclear reactors.
- C04** Summarize the environmental and economic issues of using renewable energy sources compared to fossil fuels.
- C05** Describe the various power plant instrumentation and control techniques.

CO - PO MAPPING:

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

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|-----------------|-------------------------------|----------|----------|----------|----------|
| U230E226 | AUTOMOTIVE ELECTRONICS | L | T | P | C |
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COURSE OBJECTIVES:

- To provide knowledge on the operation of thermal power plant and the subsystems including fuel Preparation and handling, boiler types.
- To impart knowledge on layout and operation of diesel and gas turbine power plants and nuclear power plants.
- To educate the environmental and cost economics of using renewable energy sources compared to fossil fuels and to introduce the importance of instrumentation, measurement and control techniques in power plants.

UNIT I INTRODUCTION 9

Evolution of electronics in automobiles – emission laws – introduction to Euro I, Euro II, Euro III, Euro IV, Euro V standards – Equivalent Bharat Standards. Charging systems: Working and design of charging circuit diagram – Alternators – Requirements of starting system - Starter motors and starter circuits.

UNIT II IGNITION AND INJECTION SYSTEMS 9

Ignition systems: Ignition fundamentals - Electronic ignition systems - Programmed Ignition – Distribution less ignition - Direct ignition – Spark Plugs. Electronic fuel Control: Basics of combustion – Engine fuelling and exhaust emissions – Electronic control of carburetion – Petrol fuel injection – Diesel fuel injection.

UNIT III SENSOR AND ACTUATORS IN AUTOMOTIVES 9

Working principle and characteristics of Airflow rate, Engine crankshaft angular position, Hall effect, Throttle angle, temperature, exhaust gas oxygen sensors – study of fuel injector, exhaust gas recirculation actuators, stepper motor actuator, and vacuum operated actuator.

UNIT IV ENGINE CONTROL SYSTEMS 9

Control modes for fuel control-engine control subsystems – ignition control methodologies – different ECU's used in the engine management – block diagram of the engine management system. In vehicle networks: CAN standard, format of CAN standard – diagnostics systems in modern automobiles.

UNIT V CHASSIS AND SAFETY SYSTEMS 9

Traction control system – Cruise control system – electronic control of automatic transmission – anti-lock braking system – electronic suspension system – working of airbag and role of MEMS in airbag systems – centralized door locking system – climate control of cars.

TOTAL: 45 PERIODS

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REFERENCES:

- 1 James D Halderman, "Automotive Electricity & Electronics", 6th Edition, Pearson Education, 2021.
- 2 James E Duffy, "Automotive Electricity & Electronics", 7th Edition, GW Publishers, 2021.
- 3 William B Ribbens, "Understanding Automotive Electronics", 8th Edition, Elsevier, 2019.

COURSE OUTCOMES:

Upon completion of the course, students will be able to

- CO1** Comprehend the importance of emission standards in automobiles.
- CO2** Explain the electronic fuel injection/ignition components and their function
- CO3** Summarize the sensors and equipment for measuring mechanical quantities, temperature and appropriate actuators.
- CO4** Describe the chassis and vehicle safety system.
- CO5** Explain the various methods of power system earthing.

CO - PO MAPPING:

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| CO2 | 2 | 2 | 1 | 1 | - | - | - | - | - | - | - | 1 |
| CO3 | 2 | 2 | 1 | 1 | - | - | - | - | - | - | - | 1 |
| CO4 | 2 | 2 | 1 | 1 | - | - | - | - | - | - | - | 1 |
| CO5 | 2 | 2 | 1 | 1 | - | - | - | - | - | - | - | 1 |

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|--|----------|----------|----------|----------|
| U230E237 NANOMATERIALS AND APPLICATIONS | L | T | P | C |
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Course Objectives:

- To understand about the nanomaterials, synthesis and its characterization.
- To describe the fabrication of nano composites and nano structures for advanced devices.
- To study about the application of nano materials in various fields of Engineering.

UNIT I BASICS OF NANOTECHNOLOGY 9

Introduction–Scientific revolutions–Time and length scale in structures –Definition of a nano system –Dimensionality and size-dependent phenomena –Surface to volume ratio - Fraction of surface atoms – Surface energy and surface stress – surface defects – Properties at nanoscale (optical, mechanical, electronic and magnetic).

UNIT II SYNTHESIS OF NANOMATERIALS 9

Bottom up and Top-down approach for obtaining nano materials - Precipitation methods – sol gel technique – high energy ball milling, CVD and PVD methods, gas phase condensation, magnetron sputtering and laser deposition methods – laser ablation, sputtering.

UNIT III NANO COMPOSITES 9

Definition- importance of nanocomposites- nano composite materials-classification of composites- metal/metal oxides, metal-polymer- thermoplastic based, thermoset based and elastomer based- influence of size, shape and role of interface in composites applications.

UNIT IV NANO STRUCTURES AND CHARACTERIZATION TECHNIQUES 9

Classifications of nanomaterials - Zero dimensional, one-dimensional and two-dimensional nanostructures- Kinetics in nanostructured materials- multilayer thin films and superlattice- clusters of metals, semiconductors and nanocomposites. Spectroscopic techniques, Diffraction methods, thermal analysis method, BET analysis method.

UNIT V APPLICATIONS OF NANO MATERIALS 9

Overview of nanomaterials properties and their applications, nano painting, nano coating, nanomaterials for renewable energy, Molecular Electronics and Nanoelectronics – Nanobots- Biological Applications. Emerging technologies for environmental applications- Practice of nanoparticles for environmental remediation and water treatment.

TOTAL : 45 PERIODS

TEXT BOOKS:

- 1 Mick Wilson, Kamali Kannangara, Burkhard Raguse, “ Nano Technology: Basic Science & Engineering Technology”, 1st Edition, Overseas Press, 2018.
- 2 G Cao, “Nanostructures & Nanomaterials: Synthesis, Properties & Applications”, 1st Edition, Imperial College Press, 2019.

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REFERENCES:

- 1 William A Goddard, "Handbook of Nanoscience, Engineering and Technology", 3rd Edition, CRC Taylor and Francis group, 2018.
- 2 R H J Hannink, A J Hill, "Nanostructure Control", 1st Edition, Wood Head Publishing Ltd., 2016.
- 3 Ivor Brodie, Julius J Muray, "The physics of Micro/Nano - Fabrication", 1st Edition, Springer International Edition, 2020.

ONLINE RESOURCES:

- 1 <https://nptel.ac.in/courses/118104008>
- 2 https://onlinecourses.nptel.ac.in/noc22_mm33/preview
- 3 <https://link.springer.com/book/10.1007/978-981-10-6214-8>

COURSE OUTCOMES:

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

- CO1** Describe the basic properties such as structural, physical, chemical properties of nano materials and their applications.
- CO2** Explain the knowledge about the different types of nano material synthesis.
- CO3** Describe about the shape, size, structure of composite nano materials and their interference.
- CO4** Describe the different characterization techniques for nanomaterials.
- CO5** Explain the application of nanomaterials in different fields.

CO - PO - PSO MAPPING:

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

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Course Objectives:

- Understand the advantages, disadvantages and general classification of plastic materials, manufacturing, sources, and applications of engineering thermoplastics.
- Understand the basics as well as the advanced applications of various plastic materials in the industry.
- To understand the preparation methods of thermosetting materials, Select suitable specialty plastics for different end applications.

UNIT I INTRODUCTION TO PLASTIC MATERIALS 9

Introduction to Plastics – Brief history of plastics, advantages and disadvantages, thermoplastic and thermosetting behaviour, amorphous polymers, crystalline polymers and cross-linked structures. General purpose thermoplastics/ Commodity plastics: manufacture, structure, properties and applications of polyethylene (PE), cross-linked PE, chlorinated PE, polypropylene, polyvinyl chloride-compounding, formulation, polypropylene (PP).

UNIT II ENGINEERING THERMOPLASTICS AND APPLICATIONS 9

Engineering thermoplastics – Aliphatic polyamides: structure, properties, manufacture and applications of Nylon 6, Nylon 66. Polyesters: manufacture, structure, properties and uses of PET, PBT. Manufacture, structure, properties and uses of Polycarbonates, actual resins, polyimides, PMMA, polyphenylene oxide, thermoplastic polyurethane (PU).

UNIT III THERMOSETTING PLASTICS 9

Thermosetting Plastics – Manufacture, curing, moulding powder, laminates, properties and uses of phenol formaldehyde resins, urea formaldehyde, melamine formaldehyde, unsaturated polyester resin, epoxy resin, silicone resins, polyurethane resins.

UNIT IV MISCELLANEOUS PLASTICS FOR END APPLICATIONS 9

Miscellaneous plastics- Manufacture, properties and uses of polystyrene, HIPS, ABS, SAN, poly(tetrafluoroethylene) (PTFE), TFE and copolymers, PVDF, PVA, poly (vinyl acetate), poly (vinyl carbazole), cellulose acetate, PEEK, High energy absorbing polymers, super absorbent polymers- their synthesis, properties and applications.

UNIT V PLASTICS MATERIALS FOR BIOMEDICAL APPLICATIONS 9

Sources, raw materials, methods of manufacturing, properties and applications of bio-based polymers- poly lactic acid (PLA), poly hydroxy alkanooates (PHA), PBAT, Bio plastics- bio-PE, bio-PP, bio-PET, polymers for biomedical applications.

TOTAL : 45 PERIODS

TEXT BOOKS:

- 1 Marianne Gilbert, Brydson's, "Plastics Materials", 8th Edition, Elsevier, 2018.
- 2 J A Brydson, "Plastics Materials", 7th Edition, Butterworth Heinemann. 2019.

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REFERENCES:

- 1 Manas Chanda, Salil K Roy, "Plastics Technology Handbook", 4th Edition, CRC press, 2018.
- 2 A Brent Strong, "Plastics: Materials and Processing", 3rd Edition, Pearson Prentice Hall of India, 2019.
- 3 Olagoke Olabisi, Kolapo Adewale, "Handbook of Thermoplastics", 2nd Edition, CRC press, 2018.

ONLINE RESOURCES:

- 1 <https://archive.nptel.ac.in/courses/112/103/112103279/>
- 2 <https://nptel.ac.in/courses/112107221>
- 3 <https://www.sciencedirect.com/materials-science/engineering-plastic>

COURSE OUTCOMES:

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

- CO1 Describe the importance, advantages and classification of plastic materials.
- CO2 Summarize the raw materials, sources, production, properties and applications of various engineering thermoplastics.
- CO3 Describe the application of polyamides, polyesters and other engineering thermoplastics, thermosetting resins.
- CO4 Explain the manufacturing properties and uses of thermosetting resins based on polyester, epoxy, silicone and PU.
- CO5 Describe the engineering applications of various polymers in miscellaneous areas and applications of different biopolymers.

CO - PO - PSO MAPPING:

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

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| | | | | | |
|----------|-------------------------------------|----------|----------|----------|----------|
| U230E239 | PRODUCTION AND OPERATIONS | L | T | P | C |
| | MANAGEMENT FOR ENTREPRENEURS | 3 | 0 | 0 | 3 |

Course Objectives:

- Discuss the basic concept and function of Production and Operation Management for entrepreneurship.
- Understand the Production process and planning.
- Describe the Production and Operations Management Control for business owners

UNIT I INTRODUCTION TO PRODUCTION AND OPERATIONS MANAGEMENT 9

Functions of Production Management - Relationship between production and other functions - Production management and operations management, Characteristics of modern production and operation management, organisation of production function, recent trends in production /operations management - production as an organisational function, decision making in production Operations research.

UNIT II PRODUCTION & OPERATION SYSTEMS 9

Production Systems- principles - Models - CAD and CAM- Automation in Production - Functions and significance- Capacity and Facility Planning: Importance of capacity planning- Capacity measurement - Capacity Requirement Planning (CRP) process for manufacturing and service industry.

UNIT III PRODUCTION & OPERATIONS PLANNING 9

Facility Planning - Location of facilities - Location flexibility - Facility design process and techniques - Location break even analysis-Production Process Planning: Characteristic of production process systems - Steps for production process-Production Planning Control Functions - Planning phase- Action phase- Control phase - Aggregate production planning.

UNIT IV PRODUCTION & OPERATIONS MANAGEMENT PROCESS 9

Process selection with PLC phases- Process simulation tools- Work Study - Significance - Methods, evolution of normal/ standard time - Job design and rating - Value Analysis - Plant Layout: meaning - characters -- Plant location techniques - Types- MRP and Layout Design - Optimisation and Theory of Constraints (TOC)- Critical Chain Project Management (CCPM)- REL (Relationship) Chart - Assembly line balancing- - Plant design optimisation -Forecasting methods.

UNIT V CONTROLLING PRODUCTION & OPERATIONS MANAGEMENT 9

Material requirement planning (MRP)- Concept- Process and control - Inventory control systems and techniques - JIT and Lean manufacturing - Network techniques - Quality Management: Preventive Vs Breakdown maintenance for Quality - Techniques for measuring quality - Control Chart (X , R , p , np and C chart) - Cost of Quality, Continuous improvement (Kaizen) - Quality awards - Supply Chain Management - Total Quality Management - 6 Sigma approach and Zero Defect Manufacturing.

TOTAL : 45 PERIODS

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TEXT BOOKS:

- 1 Mikell P Groover, "Automation Production Systems, and Computer-Integrated Manufacturing", 1st Edition, Pearson Education, 2018.
- 2 Amitabh Raturi, "Production and Inventory Management", 1st Edition, Tata McGraw Hill Publications, 2018.

REFERENCES:

- 1 Adam Jr Ebert, "Production and Operations Management", 1st Edition, Prentice Hall of India Publication, 2020.
- 2 Muhlemann, Okland, Lockyer, "Production and Operation Management", 1st Edition, Macmillan, 2019.
- 3 Chary S N, "Production and Operations Management", 1st Edition, Tata McGraw Hill Publications, 2019.

ONLINE RESOURCES:

- 1 <https://openstax.org/books/introduction-business/pages/10-1-production-and-operations-management-an-overview>
- 2 https://onlinecourses.nptel.ac.in/noc20_mg06/preview
- 3 https://www.vssut.ac.in/lecture_notes/lecture1429900757.pdf

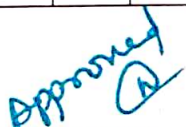
COURSE OUTCOMES:

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

- CO1** Explain the basics and functions of Production and Operation Management for owners.
- CO2** Summarize the concept of the Production & Operation Systems.
- CO3** Explain the Production & Operations Planning Techniques followed by entrepreneurs in Industries.
- CO4** Describe the Production & Operations Management Processes in organisations.
- CO5** Explain the techniques of controlling, Production and Operations in industries.

CO - PO - PSO MAPPING:

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


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U23OE240

QUALITY ENGINEERING

| | | | |
|---|---|---|---|
| L | T | P | C |
| 3 | 0 | 0 | 3 |

Course Objectives:

- Developing a clear knowledge in the basics of various quality concepts.
- Facilitating the students in understanding the application of control charts and its techniques.
- Analysing and understanding the process capability study.

UNIT I

INTRODUCTION

9

Quality Dimensions–Quality definitions–Inspection–Quality control–Quality Assurance– Quality planning–Quality costs–Economics of quality– Quality loss function.

UNIT II

CONTROL CHARTS

9

Chance and assignable causes of process variation, statistical basis of the control chart, control charts for variables- X , R and S charts, attribute control charts - p, np, c and u- Construction and application.

UNIT III

SPECIAL CONTROL PROCEDURES

9

Warning and modified control limits, control chart for individual measurements, multi- vari chart, Xchart with a linear trend, chart for moving averages and ranges, cumulative- sum and exponentially weighted moving average control charts.

UNIT IV

STATISTICAL PROCESS CONTROL

9

Process stability, process capability analysis using a Histogram or probability plots and control chart. Gauge capability studies, setting specification limits.

UNIT V

ACCEPTANCE SAMPLING

9

The acceptance sampling fundamental, OC curve, sampling plans for attributes, simple, double, multiple and sequential, sampling plans for variables, MIL-STD-105D and MIL- STD-414E&IS2500 standards.

TOTAL : 45 PERIODS

TEXT BOOKS:

- 1 Douglass C Montgomery, "Introduction to Statistical Quality Control", 7th Edition, John Wiley & sons, 2018.
- 2 Krishnaiah K, "Applied Statistical Quality Control and Improvement", 1st Edition, Prentice Hall of India, 2020.

REFERENCES:

- 1 Amitava Mitra, "Fundamentals of Quality Control and Improvement", 3rd Edition, John Wiley & sons, 2018.
- 2 Eugene L Grant and Richard S. Leaven Worth, "Statistical Quality Control", 7th Edition, Tata McGraw- Hill, 2019.
- 3 Manohar Mahajan, "Statistical Quality Control", 1st Edition, Dhanpal Rai & Sons, 2021.


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ONLINE RESOURCES:

- 1 <https://nptel.ac.in/courses/116102019>
- 2 https://github.com/johnros/qualityEngineering/blob/master/Class_notes/notes.pdf
- 3 <https://archive.nptel.ac.in/courses/112/107/112107259/>

COURSE OUTCOMES:

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

- C01** Describe the quality of processes using control charts for variables in manufacturing industries.
- C02** Describe the occurrence of defective products and the defects in manufacturing companies.
- C03** Describe the occurrence of defects in services.
- C04** Analyze the statistical and process capability study.
- C05** Create the acceptance sampling procedures for incoming raw material.

CO - PO - PSO MAPPING:

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

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U23OE241

REVERSE ENGINEERING

| | | | |
|----------|----------|----------|----------|
| L | T | P | C |
| 3 | 0 | 0 | 3 |

Course Objectives:

- Applying the fundamental concepts and principles of reverse engineering in product design and development.
- Applying the concept and principles material characteristics, part durability and life limitation in reverse engineering of product design and development.
- Analysing the various legal aspects and applications of reverse engineering in product design and development and discuss about 3D scanning hardware & software operations and procedure to generate 3D models.

UNIT I INTRODUCTION & GEOMETRIC FORM 9

Definition – Uses – The Generic Process – Phases – Computer Aided Reverse Engineering - Surface and Solid Model Reconstruction – Dimensional Measurement – Prototyping.

UNIT II MATERIAL CHARACTERISTICS AND PROCESS IDENTIFICATION 9

Alloy Structure Equivalency – Phase Formation and Identification – Mechanical Strength – Hardness –Part Failure Analysis – Fatigue – Creep and Stress Rupture – Environmentally Induced Failure Material Specification - Composition Determination - Microstructure Analysis - Manufacturing Process Verification.

UNIT III DATA PROCESSING 9

Statistical Analysis – Data Analysis – Reliability and the Theory of Interference – Weibull Analysis – Data Conformity and Acceptance – Data Report – Performance Criteria – Methodology of Performance Evaluation – System Compatibility.

UNIT IV 3D SCANNING AND MODELLING 9

Introduction, working principle and operations of 3D scanners: Laser, White Light, Blue Light - Applications- Software for scanning and modelling: Types- Applications-Preparation techniques for Scanning objects- Scanning and Measuring strategies - Calibration of 3D Scanner- Step by step procedure: 3D scanning - Geometric modelling – 3D inspection- Case studies.

UNIT V INDUSTRIAL APPLICATIONS 9

Reverse Engineering in the Automotive Industry; Aerospace Industry; Medical Device Industry. Case studies and Solving Industrial projects in Reverse Engineering. Legality: Patent – Copyrights –Trade Secret – Third-Party Materials.

TOTAL : 45 PERIODS

TEXT BOOKS:

- 1 Robert W Messler, "Reverse Engineering: Mechanisms, Structures, Systems & Materials", 1st Edition, Tata McGraw-Hill Education, 2019.
- 2 Wego Wang, "Reverse Engineering Technology of Reinvention", 1st Edition, CRC Press, 2019.

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REFERENCES:

- 1 Scott J Lawrence, "Principles of Reverse Engineering", 1st Edition, Kindle, 2022.
- 2 Kevin Otto, Kristin Wood, "Product Design: Techniques in Reverse Engineering and New Product Development", 1st Edition, Prentice Hall of India, 2019.
- 3 Linda Wills, "Reverse Engineering", 1st Edition, Kluwer Academic Publishers, 2020.

ONLINE RESOURCES:

- 1 <https://nptel.ac.in/courses/112104265>
- 2 <https://archive.nptel.ac.in/courses/112/104/112104265/>
- 3 <http://www.digimat.in/nptel/courses/video/112104230/L49.html>

COURSE OUTCOMES:

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

- CO1** Explain the fundamental concepts and principles of reverse engineering in product design and development.
- CO2** Apply the concept of material characteristics, part durability and life limitation in reverse engineering of product design and development.
- CO3** Apply the concept and principles of material identification and process verification in reverse engineering of product design and development.
- CO4** Describe the concept and principles of data processing, part performance and system compatibility in reverse engineering of product design and development.
- CO5** Summarize the various legal aspect and Applications of reverse engineering in product design and development.

CO - PO - PSO MAPPING:

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

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