# R.M.D. ENGINEERING COLLEGE

**(An Autonomous Institution)**

R.S.M Nagar, Kavaraipettai, Gummidipoondi Taluk,

Thiruvallur District, Tamil Nadu- 601206

Affiliated to Anna University, Chennai / Approved by AICTE, New Delhi /

Accredited by NAAC /All the Eligible UG Programs are Accredited by NBA, New Delhi

**B.Tech. Degree in**

**INFORMATION TECHNOLOGY**

**CURRICULUM AND SYLLABI**

**REGULATIONS 2024**

**CHOICE BASED CREDIT SYSTEM**

**(For the students admitted in the Academic Year 2024 – 2025)**

**DEPARTMENT OF INFORMATION TECHNOLOGY**

**R.M.D. ENGINEERING COLLEGE**

**KAVARAIPETTAI – 601 206**

**TAMILNADU, INDIA.**

# R.M.D. ENGINEERING COLLEGE
## (An Autonomous Institution)
## B.TECH INFORMATION TECHNOLOGY
## REGULATIONS – 2024
## CHOICE BASED CREDIT SYSTEM

## PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

1. To ensure graduates will be proficient in utilizing the fundamental knowledge of basic sciences, mathematics and Information Technology for the applications relevant to various streams of Engineering and Technology.

2. To enrich graduates with the core competencies necessary for applying knowledge of computers and telecommunications equipment to store, retrieve, transmit, manipulate and analyze data in the context of business enterprise.

3. To enable graduates to think logically, pursue lifelong learning and will have the capacity to understand technical issues related to computing systems and to design optimal solutions.

4. To enable graduates to develop hardware and software systems by understanding the importance of social, business and environmental needs in the human context.

5. To enable graduates to gain employment in organizations and establish themselves as professionals by applying their technical skills to solve real world problems and meet the diversified needs of industry, academia and research.

## PROGRAM OUTCOMES (POs)

## ENGINEERING GRADUATES WILL BE ABLE TO:

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

2. **Problem Analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

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

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

10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

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

**PROGRAM SPECIFIC OBJECTIVES (PSOs)**

**After the successful completion of the program, the graduates will be able to:**

1. To create, select, and apply appropriate techniques, resources, modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
2. To manage complex IT projects with consideration of the human, financial, ethical and environmental factors and an understanding of risk management processes, and operational and policy implications.
3. Identify and utilize the strengths of current technologies in the hardware/support and mobile technology domains in implementing IT enabled services for societal needs.

## MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES WITH PROGRAMME OUTCOMES

A broad relation between the programme objective and the outcomes is given in the following table

| PROGRAMME EDUCATIONAL OBJECTIVES (PEOs) | PROGRAMME OUTCOMES (POs) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| PEO1 | 3 | 2 | | | | | | | | | | 2 |
| PEO2 | 3 | 3 | 1 | 1 | | | | | | | | 2 |
| PEO3 | | | 3 | | | 1 | | | | | | 3 |
| PEO4 | | | 3 | | 1 | 2 | 3 | 1 | | | | |
| PEO5 | | | | 3 | | | | 1 | 1 | 2 | 2 | 1 |

## MAPPING OF PROGRAM SPECIFIC OBJECTIVES WITH PROGRAMME OUTCOMES

A broad relation between the Program Specific Objectives and the outcomes is given in the following table

| PROGRAM SPECIFIC OBJECTIVES (PSOs) | PROGRAMME OUTCOMES | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| PSO1 | 3 | 2 | | | 3 | | | | 2 | 2 | | 3 |
| PSO2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| PSO3 | | | | 3 | | | 3 | 3 | | | 3 | 2 |

Contribution 1: Reasonable 2: Significant 3: Strong

# R.M.D. ENGINEERING COLLEGE

**(An Autonomous Institution)**

**B.TECH-INFORMATION TECHNOLOGY**

**REGULATIONS 2024**

**I – VIII SEMESTER CURRICULUM**

**(For the Students Admitted During the Academic Year 2024-2025)**

| SEMESTER-I | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **S.No** | **Course Code** | **Name of the Course** | **Category** | **Contact Periods** | **L** | **T** | **P** | **C** |
| 1 | 24MA101 | Matrices and Calculus | BSC | 4 | 3 | 1 | 0 | 4 |
| 2 | 24CS101 | Programming in C++ (Lab Integrated) | ESC | 6 | 3 | 0 | 3 | 4.5 |
| 3 | 24CS102 | Software Development Practices (Lab Integrated) | ESC | 6 | 3 | 0 | 3 | 4.5 |
| 4 | 24CH101 | Engineering Chemistry (Lab Integrated) | BSC | 5 | 3 | 0 | 2 | 4 |
| 5 | 24EC102 | Digital Principles and System Design(Lab Integrated) | ESC | 5 | 3 | 0 | 2 | 4 |
| 6 | 24GE102 | Heritage of Tamils | HSMC | 1 | 1 | 0 | 0 | 1 |
| 7 | 24MC101 | Students Induction Program (Non-Credit) | MC 3 Weeks | | | | | |
| 8 | 24MC103 | Programming in C (Non-Credit) | MC 40 Periods | | | | | |
| 9 | 24HS111 | Interpersonal skills, Psychometric Analysis and Career Development | EEC | 1 | 1 | 0 | 0 | 1 |
| 10 | 24GE111 | Idea Lab I (Non-Credit) | EEC | 1 | 0 | 0 | 1 | 0 |
| **Total** | | | | **29** | **17** | **1** | **11** | **23** |

| SEMESTER-II | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **S.No** | **Course Code** | **Name of the Course** | **Category** | **Contact Periods** | **L** | **T** | **P** | **C** |
| 1 | 24MA201 | Linear Algebra and Applications (Lab Integrated) | BSC | 5 | 3 | 0 | 2 | 4 |
| 2 | 24CS201 | Data Structures (Lab Integrated) | ESC | 6 | 3 | 0 | 3 | 4.5 |
| 3 | 24CS202 | Java Programming (Lab Integrated) | ESC | 6 | 3 | 0 | 3 | 4.5 |
| 4 | 24PH201 | Physics for Information Science (Lab Integrated) | BSC | 5 | 3 | 0 | 2 | 4 |
| 5 | 24AM201 | Introduction to Artificial Intelligence (Lab Integrated) | ESC | 4 | 2 | 0 | 2 | 3 |
| 6 | 24GE201 | Tamils and Technology | HSMC | 1 | 1 | 0 | 0 | 1 |
| 7 | 24GE211 | Idea Lab-II | EEC | 2 | 0 | 0 | 2 | 1 |
| 8 | 24HS211 | Innovation and Creativity Skills Development | EEC | 1 | 1 | 0 | 0 | 1 |
| 9 | 24AC201 | Yoga for Stress Management (Non-Credit) | AC | 1 | 0 | 0 | 1 | 0 |
| 10 | 24MC102 | Environmental Science and Sustainability (Non-Credit) | MC | 2 | 2 | 0 | 0 | 0 |
| **Total** | | | | **33** | **18** | **0** | **15** | **23** |

| SEMESTER-III | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **S.No** | **Course Code** | **Name of the Course** | **Category** | **Contact Periods** | **L** | **T** | **P** | **C** |
| **THEORY COURSES** | | | | | | | | |
| 1 | 24MA301 | Discrete Mathematics | BSC | 4 | 3 | 1 | 0 | 4 |
| 2 | 24GE301 | Universal Human Values II: Understanding Harmony | HSMC | 3 | 2 | 1 | 0 | 3 |
| 3 | 24CS301 | Computer Organization and Architecture | ESC | 3 | 3 | 0 | 0 | 3 |
| **THEORY COURSES WITH LABORATORY COMPONENT** | | | | | | | | |
| 4 | 24CS302 | Advanced Java Programming (Lab Integrated) | PCC | 6 | 3 | 0 | 3 | 4.5 |
| 5 | 24CS303 | Database Management Systems (Lab Integrated) | PCC | 6 | 3 | 0 | 3 | 4.5 |
| 6 | 24CS304 | Operating Systems (Lab Integrated) | PCC | 4 | 2 | 0 | 2 | 3 |
| **LABORATORY COURSES** | | | | | | | | |
| 7 | 24GE311 | Product Development Lab-I | EEC | 2 | 0 | 0 | 2 | 1 |
| 8 | 24CS311 | Aptitude and Coding Skills-I | EEC | 3 | 0 | 0 | 3 | 1.5 |
| 9 | 24CS312 | Internship/Seminar (1 Week) | EEC | 1 | 0 | 0 | 1 | 0.5 |
| **MANDATORY COURSES** | | | | | | | | |
| 10 | 24MC301 | Indian Constitution(Non-Credit) | MC | 1 | 1 | 0 | 0 | 0 |
| | | | **Total** | **33** | **18** | **1** | **14** | **25** |

| SEMESTER-IV | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **S.No** | **Course Code** | **Name of the Course** | **Category** | **Contact Periods** | **L** | **T** | **P** | **C** |
| **THEORY COURSES WITH LABORATORY COMPONENT** | | | | | | | | |
| 1 | 24MA401 | Probability and Statistics (Lab Integrated) | BSC | 5 | 3 | 0 | 2 | 4 |
| 2 | 24CS402 | Design and Analysis of Algorithms(Lab Integrated) | PCC | 5 | 3 | 0 | 2 | 4 |
| 3 | 24IT401 | Managing Cloud and Containerization (Lab Integrated) | PCC | 5 | 3 | 0 | 2 | 4 |
| 4 | 24IT402 | Web Development Frameworks (Lab Integrated) | PCC | 6 | 3 | 0 | 3 | 4.5 |
| 5 | | Professional Elective I (Lab Integrated) | PEC | 4 | 2 | 0 | 2 | 3 |
| **EMPLOYABILITY ENHANCEMENT COURSES** | | | | | | | | |
| 6 | 24GE411 | Product Development Lab-II | EEC | 2 | 0 | 0 | 2 | 1 |
| 7 | 24CS411 | Aptitude and Coding Skills-II | EEC | 3 | 0 | 0 | 3 | 1.5 |
| **AUDIT COURSES** | | | | | | | | |
| 8 | 24AC401 | Value Education (Non-Credit) | AC | 1 | 1 | 0 | 0 | 0 |
| **Total** | | | | **31** | **15** | **0** | **16** | **22** |

**HONORS/MINOR SEMESTER IV**

| SEMESTER –IV | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Sl. No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
| **For Honors Degree** | | | | | | | | |
| 1 | | Capstone Design Project – Level 1 | EEC | 12 | 0 | 0 | 12 | 6 |
| OR | | | | | | | | |
| 1 | | Honors Elective -I | PEC | 3 | 3 | 0 | 0 | 3 |
| 2 | | Honors Elective -II | PEC | 3 | 3 | 0 | 0 | 3 |
| **TOTAL CREDITS** | | | | | | | | 6 |
| **For Minor Degree** | | | | | | | | |
| 1 | | Minor Elective - I | OEC | 3 | 3 | 0 | 0 | 3 |
| 2 | | Minor Elective - II | OEC | 3 | 3 | 0 | 0 | 3 |
| **TOTAL CREDITS** | | | | | | | | 6 |

| SEMESTER-V | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **S.No** | **Course Code** | **Name of the Course** | **Category** | **Contact Periods** | **L** | **T** | **P** | **C** |
| **THEORY COURSES WITH LABORATORY COMPONENT** | | | | | | | | |
| 1 | 24IT501 | Data Communications and Computer Networks(Lab Integrated) | PCC | 5 | 3 | 0 | 2 | 4 |
| 2 | 24CS701 | Data Analytics (Lab Integrated) | PCC | 4 | 2 | 0 | 2 | 3 |
| 3 | 24IT502 | Machine Learning (Lab Integrated) | PCC | 5 | 3 | 0 | 2 | 4 |
| 4 | | Professional Elective II (Lab Integrated) | PEC | 4 | 2 | 0 | 2 | 3 |
| 5 | | Professional Elective III (Lab Integrated) | PEC | 4 | 2 | 0 | 2 | 3 |
| **EMPLOYABILITY ENHANCEMENT COURSES** | | | | | | | | |
| 6 | | Professional Communication-I (TOEFL) | HSMC | 4 | 0 | 0 | 4 | 2 |
| 7 | 24CS511 | Advanced Aptitude and Coding Skills-I | EEC | 3 | 0 | 0 | 3 | 1.5 |
| 8 | 24IT511 | Internship/Seminar (2 Weeks) | EEC | 2 | 0 | 0 | 2 | 1 |
| 9 | 24GE511 | Product Development Lab-III | EEC | 2 | 0 | 0 | 2 | 1 |
| **MANDATORY COURSES** | | | | | | | | |
| 10 | 24MC501 | Essence of Indian Traditional Knowledge (Non-Credit) | MC | 1 | 1 | 0 | 0 | 0 |
| **Total** | | | | **34** | **13** | **0** | **21** | **22.5** |

## HONORS/MINOR SEMESTER V

| SEMESTER – V | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Sl. No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
| **For Honors Degree** | | | | | | | | |
| 1 | | Capstone Design Project – Level II | EEC | 12 | 0 | 0 | 12 | 6 |
| OR | | | | | | | | |
| 1 | | Honors Elective -III | PEC | 3 | 3 | 0 | 0 | 3 |
| 2 | | Honors Elective -IV | PEC | 3 | 3 | 0 | 0 | 3 |
| **TOTAL CREDITS** | | | | | | | | 6 |
| **For Minor Degree** | | | | | | | | |
| 1 | | Minor Elective - III | OEC | 3 | 3 | 0 | 0 | 3 |
| 2 | | Minor Elective - IV | OEC | 3 | 3 | 0 | 0 | 3 |
| **TOTAL CREDITS** | | | | | | | | 6 |

| SEMESTER-VI | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **S.No** | **Course Code** | **Name of the Course** | **Category** | **Contact Periods** | **L** | **T** | **P** | **C** |
| **THEORY COURSES** | | | | | | | | |
| 1 | | Open Elective I | OEC | 3 | 3 | 0 | 0 | 3 |
| **THEORY COURSES WITH LABORATORY COMPONENT** | | | | | | | | |
| 2 | 24IT601 | Mobile Application Framework and Development (Lab Integrated) | PCC | 5 | 3 | 0 | 2 | 4 |
| 3 | 24IT602 | Application System Design with UML (Lab Integrated) | PCC | 4 | 2 | 0 | 2 | 3 |
| 4 | 24CS602 | Cryptography and Cyber Security (Lab Integrated) | PCC | 4 | 2 | 0 | 2 | 3 |
| 5 | | Design Thinking(Lab Integrated) | HSMC | 3 | 1 | 0 | 2 | 2 |
| 6 | | Professional Elective IV (Lab Integrated) | PEC | 4 | 2 | 0 | 2 | 3 |
| **EMPLOYABILITY ENHANCEMENT COURSES** | | | | | | | | |
| 7 | | Professional Communication-II (TOEFL) | HSMC | 2 | 0 | 0 | 2 | 1 |
| 8 | 24CS611 | Advanced Aptitude and Coding Skills-II | EEC | 3 | 0 | 0 | 3 | 1.5 |
| 9 | 24GE611 | Product Development Lab-IV | EEC | 2 | 0 | 0 | 2 | 1 |
| **MANDATORY COURSES** | | | | | | | | |
| 10 | 24AC601 | Personality Development (Non-Credit) | AC | 2 | 2 | 0 | 0 | 0 |
| **Total** | | | | **32** | **15** | **0** | **17** | **21.5** |

## HONORS/MINOR SEMESTER VI

| SEMESTER – VI | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Sl. No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
| **For Honors Degree** | | | | | | | | |
| 1 | | Capstone Design Project – Level III | EEC | 12 | 0 | 0 | 12 | 6 |
| OR | | | | | | | | |
| 1 | | Honors Elective -V | PEC | 3 | 3 | 0 | 0 | 3 |
| 2 | | Honors Elective -VI | PEC | 3 | 3 | 0 | 0 | 3 |
| **TOTAL CREDITS** | | | | | | | | 6 |
| **For Minor Degree** | | | | | | | | |
| 1 | | Capstone Design Project | EEC | 12 | 0 | 0 | 12 | 6 |
| **TOTAL CREDITS** | | | | | | | | 6 |

| SEMESTER-VII | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **S.No** | **Course Code** | **Name of the Course** | **Category** | **Contact Periods** | **L** | **T** | **P** | **C** |
| **THEORY COURSES** | | | | | | | | |
| 1 | | Open Elective II | OEC | 3 | 3 | 0 | 0 | 3 |
| **THEORY COURSES WITH LABORATORY COMPONENT** | | | | | | | | |
| 2 | 24CS702 | Wireless and Mobile Communication (Lab Integrated) | PCC | 5 | 3 | 0 | 2 | 4 |
| 3 | 24IT701 | Microservice Architecture (Lab Integrated) | PCC | 4 | 2 | 0 | 2 | 3 |
| 4 | | Professional Elective V (Lab Integrated) | PEC | 4 | 2 | 0 | 2 | 3 |
| 5 | | Professional Elective-VI (Lab Integrated) | PEC | 4 | 2 | 0 | 2 | 3 |
| **EMPLOYABILITY ENHANCEMENT COURSES** | | | | | | | | |
| 6 | 24IT711 | Internship/Seminar(4weeks) | EEC | 4 | 0 | 0 | 4 | 2 |
| **Total** | | | | **24** | **12** | **0** | **12** | **18** |

| SEMESTER-VIII | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **S.No** | **Course Code** | **Name of the Course** | **Category** | **Contact Periods** | **L** | **T** | **P** | **C** |
| **EMPLOYABILITY ENHANCEMENT COURSES** | | | | | | | | |
| 1 | 24IT811 | Project Work | EEC | 16 | 0 | 0 | 16 | 8 |
| **Total** | | | | **16** | **0** | **0** | **16** | **8** |

## SUMMARY OF CREDIT DISTRIBUTION

| S.NO | CATEGORY | CREDITS PER SEMESTER | | | | | | | | TOTAL CREDITS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | I | II | III | IV | V | VI | VII | VIII | |
| 1 | HSMC | 1 | 1 | 3 | - | 2 | 3 | - | - | 10 |
| 2 | BSC | 8 | 8 | 4 | 4 | - | - | - | - | 24 |
| 3 | ESC | 13 | 9 | - | - | - | - | - | - | 22 |
| 4 | PCC | - | 3 | 15 | 12.5 | 11 | 10 | 7 | - | 58.5 |
| 5 | PEC | - | - | - | 3 | 6 | 3 | 6 | - | 18 |
| 6 | OEC | - | - | - | - | - | 3 | 3 | - | 6 |
| 7 | EEC | 1 | 2 | 3 | 2.5 | 3.5 | 2.5 | 2 | 8 | 24.5 |
| 8 | MC/AC | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | |
| TOTAL | | 23 | 23 | 25 | 22 | 22.5 | 21.5 | 18 | 8 | 163 |

**HSMC - Humanities and Social Sciences including Management Course;**

**BSC – Basic Science Course;**

**ESC – Engineering Science Course;**

**PCC – Professional Core Course;**

**PEC – Professional Elective Course;**

**OEC – Open Elective Course;**

**EEC – Employability Enhancement Course;**

**MC – Mandatory Course;**

**AC – Audit Course.**

## PROFESSIONAL ELECTIVE COURSES - VERTICALS

### VERTICAL I- DATA SCIENCE

| Sl. No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1. | 24IT907 | Foundations of Data Science | PEC | 3 | 3 | 0 | 0 | 3 |
| 2. | 24IT908 | Data Engineering in Cloud | PEC | 3 | 3 | 0 | 0 | 3 |
| 3. | 24IT909 | Image and Video Analytics | PEC | 3 | 3 | 0 | 0 | 3 |
| 4. | 24IT910 | Text and Speech Analytics | PEC | 3 | 3 | 0 | 0 | 3 |
| 5. | 24IT911 | Stream Processing and Analytics | PEC | 3 | 3 | 0 | 0 | 3 |
| 6. | 24IT912 | Business Intelligence on Oracle Cloud(Oracle Cloud Business Intelligence Reporting 2021 Certified Specialist) | PEC | Credit Transfer Course | | | | 3 |

### VERTICAL II- CYBER SECURITY

| Sl. No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1. | 24IT913 | Social Network Security | PEC | 4 | 2 | 0 | 2 | 3 |
| 2. | 24IT914 | Malware Analysis | PEC | 3 | 3 | 0 | 0 | 3 |
| 3. | 24IT915 | Cloud and Data Security | PEC | 3 | 3 | 0 | 0 | 3 |
| 4. | 24IT916 | Digital and Mobile Forensics | PEC | 3 | 3 | 0 | 0 | 3 |
| 5. | 24IT917 | Vulnerability Analysis and Penetration Testing | PEC | 3 | 3 | 0 | 0 | 3 |
| 6. | 24IT918 | Certified Ethical Hacking | PEC | Credit Transfer Course | | | | 3 |

## VERTICAL III- FULL STACK ENGINEERING

| Sl. No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1. | 24IT901 | Software Testing and Automation | PEC | 4 | 2 | 0 | 2 | 3 |
| 2. | 24IT902 | Server-side Programming | PEC | 4 | 2 | 0 | 2 | 3 |
| 3. | 24IT903 | REST Application Development using Spring Boot and JPA | PEC | 4 | 2 | 0 | 2 | 3 |
| 4. | 24IT904 | DevOps | PEC | 4 | 2 | 0 | 2 | 3 |
| 5. | 24IT905 | Web Application Security | PEC | 4 | 2 | 0 | 2 | 3 |
| 6. | 24IT906 | Java Development on Oracle Cloud(Oracle Java SE 11 / 17 Developer Certification) | PEC | Credit Transfer Course | | | | 3 |

## VERTICAL IV- MEDIA PROCESSING

| Sl. No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1. | 24IT919 | Augmented and Virtual Reality | PEC | 4 | 2 | 0 | 2 | 3 |
| 2. | 24IT920 | Computer Graphics and Multimedia | PEC | 3 | 3 | 0 | 0 | 3 |
| 3. | 24IT921 | Human Computer Interaction | PEC | 3 | 3 | 0 | 0 | 3 |
| 4. | 24IT922 | Visual Effects | PEC | 3 | 3 | 0 | 0 | 3 |
| 5. | 24IT923 | Game Design | PEC | 3 | 3 | 0 | 0 | 3 |
| 6. | 24IT924 | Unity Certified Associate: Game Developer | PEC | Credit Transfer Course | | | | 3 |

## VERTICAL V- FIN TECH AND WEB 3.0

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| Sl. No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1. | 24IT925 | Blockchain Technologies | PEC | 3 | 3 | 0 | 0 | 3 |
| 2. | 24IT926 | Introduction to Fintech | PEC | 3 | 3 | 0 | 0 | 3 |
| 3. | 24IT927 | Bitcoin and Cryptocurrency | PEC | 3 | 3 | 0 | 0 | 3 |
| 4. | 24IT928 | Blockchain Development | PEC | 3 | 3 | 0 | 0 | 3 |
| 5. | 24IT929 | Decentralized Finance (DeFi) | PEC | 3 | 3 | 0 | 0 | 3 |
| 6. | 24IT930 | Blockchain Developer | PEC | Credit Transfer Course | | | | 3 |

## VERTICAL VI- ARTIFICIAL INTELLIGENCE AND MACHINNE LEARNING

| Sl. No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1. | 24IT931 | Reinforcement and Ensemble Learning | PEC | 3 | 3 | 0 | 0 | 3 |
| 2. | 24IT932 | Applied AI and ML | PEC | 3 | 3 | 0 | 0 | 3 |
| 3. | 24IT933 | Social Network Analysis | PEC | 3 | 3 | 0 | 0 | 3 |
| 4. | 24IT934 | Soft Computing | PEC | 3 | 3 | 0 | 0 | 3 |
| 5. | 24IT935 | Computational Neuroscience | PEC | 3 | 3 | 0 | 0 | 3 |
| 6. | 24IT936 | Machine Learning on Oracle Cloud(Oracle Machine Learning using Autonomous Database 2021 Certified Specialist) | PEC | Credit Transfer Course | | | | 3 |

## VERTICAL VII- QUANTUM COMPUTING

| Sl. No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1. | 24IT937 | Introduction to Quantum Computing | PEC | 3 | 3 | 0 | 0 | 3 |
| 2. | 24IT938 | Quantum Information Theory | PEC | 3 | 3 | 0 | 0 | 3 |
| 3. | 24IT939 | Quantum Computing Architecture | PEC | 3 | 3 | 0 | 0 | 3 |
| 4. | 24IT940 | Quantum Algorithms | PEC | 3 | 3 | 0 | 0 | 3 |
| 5. | 24IT941 | Quantum Statistical Data Analysis | PEC | 3 | 3 | 0 | 0 | 3 |

## OPEN ELECTIVE COURSES – OFFERED TO OTHER DEPARTMENTS

| Sl. No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1. | 24IT001 | Software Testing and Automation | PEC | 3 | 3 | 0 | 0 | 3 |
| 2. | 24IT002 | Managing Cloud and Containerization | PEC | 3 | 3 | 0 | 0 | 3 |
| 3. | 24IT003 | REST Application Development using Spring Boot and JPA | PEC | 3 | 3 | 0 | 0 | 3 |
| 4. | 24IT004 | UI and UX Design | PEC | 3 | 3 | 0 | 0 | 3 |

# CURRICULUM OF B.TECH (HONOURS) IN INFORMATION TECHNOLOGY WITH SPECIALIZATION IN

**Data Science| Cyber Security | Full Stack Engineering | Media Processing| Fintech and Web 3.0 | Artificial Intelligence | Quantum Computing**

## HONOURS DEGREE WITH SPECIALIZATION IN DATA SCIENCE

| Sl. No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1. | 24IT950 | Neural Networks and Deep Learning | PEC | 3 | 3 | 0 | 0 | 3 |
| 2. | 24IT951 | Recommender Systems | PEC | 3 | 3 | 0 | 0 | 3 |
| 3. | 24IT952 | Data Exploration and Visualization | PEC | 3 | 3 | 0 | 0 | 3 |
| 4. | 24IT953 | Cognitive Science and Analytics | PEC | 3 | 3 | 0 | 0 | 3 |
| 5. | 24IT954 | Capstone Design Project | EEC | 12 | 0 | 0 | 12 | 6 |
| | | | **Total** | **24** | **12** | **0** | **12** | **18** |

## HONOURS DEGREE WITH SPECIALIZATION IN CYBER SECURITY

| Sl. No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1. | 24IT955 | Engineering Secure Software Systems | PEC | 3 | 3 | 0 | 0 | 3 |
| 2. | 24IT956 | Network Design and Programming | PEC | 3 | 3 | 0 | 0 | 3 |
| 3. | 24IT957 | Fault Tolerant Computing | PEC | 3 | 3 | 0 | 0 | 3 |
| 4. | 24IT958 | Enterprise Cyber Security | PEC | 3 | 3 | 0 | 0 | 3 |
| 5. | 24IT959 | Capstone Design Project | EEC | 12 | 0 | 0 | 12 | 6 |
| | | | **Total** | **24** | **12** | **0** | **12** | **18** |

## HONOURS DEGREE WITH SPECIALIZATION IN FULL STACK ENGINEERING

| Sl. No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1. | 24IT960 | Front End Engineering | PEC | 3 | 3 | 0 | 0 | 3 |
| 2. | 24IT961 | Server-Side Engineering | PEC | 3 | 3 | 0 | 0 | 3 |
| 3. | 24IT962 | Scalable Messaging Infrastructure - Apache Kafka | PEC | 3 | 3 | 0 | 0 | 3 |
| 4. | 24IT963 | Usability Design of Software Application | PEC | 3 | 3 | 0 | 0 | 3 |
| 5. | 24IT964 | Capstone Design Project | EEC | 12 | 0 | 0 | 12 | 6 |
| | | | **Total** | **24** | **12** | **0** | **12** | **18** |

## HONOURS DEGREE WITH SPECIALIZATION IN MEDIA PROCESSING

| Sl. No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1. | 24IT965 | Design Programming | PEC | 3 | 3 | 0 | 0 | 3 |
| 2. | 24IT966 | Computer Graphics for Virtual Reality | PEC | 3 | 3 | 0 | 0 | 3 |
| 3. | 24IT967 | Concepts of Virtual and Augmented Reality | PEC | 3 | 3 | 0 | 0 | 3 |
| 4. | 24IT968 | Mobile VR and AI in Moduley | PEC | 3 | 3 | 0 | 0 | 3 |
| 5. | 24IT969 | Capstone Design Project | EEC | 12 | 0 | 0 | 12 | 6 |
| | | | **Total** | **24** | **12** | **0** | **12** | **18** |

## HONOURS DEGREE WITH SPECIALIZATION IN FINTECH AND WEB 3.0

| Sl. No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1. | 24IT970 | Fundamentals of Blockchain | PEC | 3 | 3 | 0 | 0 | 3 |
| 2. | 24IT971 | Smart Contracts and Solidity | PEC | 3 | 3 | 0 | 0 | 3 |
| 3. | 24IT972 | Blockchain Platforms and Usecases | PEC | 3 | 3 | 0 | 0 | 3 |
| 4. | 24IT973 | Blockchain Security and Performance | PEC | 3 | 3 | 0 | 0 | 3 |
| 5. | 24IT974 | Capstone Design Project | EEC | 12 | 0 | 0 | 12 | 6 |
| | | | **Total** | **24** | **12** | **0** | **12** | **18** |

## HONOURS DEGREE WITH SPECIALIZATION IN ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

| Sl. No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1. | 24IT975 | Foundations of Deep Learning | PEC | 3 | 3 | 0 | 0 | 3 |
| 2. | 24IT976 | Knowledge Engineering | PEC | 3 | 3 | 0 | 0 | 3 |
| 3. | 24IT977 | Computer Vision | PEC | 3 | 3 | 0 | 0 | 3 |
| 4. | 24IT978 | Foundations of Natural Language Processing | PEC | 3 | 3 | 0 | 0 | 3 |
| 5. | 24IT979 | Capstone Design Project | EEC | 12 | 0 | 0 | 12 | 6 |
| | | | **Total** | **24** | **12** | **0** | **12** | **18** |

## HONOURS DEGREE WITH SPECIALIZATION IN QUANTUM COMPUTING

| Sl. No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1. | 24IT980 | Quantum Computing Foundations | PEC | 3 | 3 | 0 | 0 | 3 |
| 2. | 24IT981 | Quantum Programming | PEC | 3 | 3 | 0 | 0 | 3 |
| 3. | 24IT982 | Quantum Cryptography | PEC | 3 | 3 | 0 | 0 | 3 |
| 4. | 24IT983 | Machine Learning with Quantum Computing | PEC | 3 | 3 | 0 | 0 | 3 |
| 5. | 24IT984 | Capstone Design Project | EEC | 12 | 0 | 0 | 12 | 6 |
| | | | **Total** | **24** | **12** | **0** | **12** | **18** |

## MINOR DEGREE WITH SPECIALIZATION IN FULL STACK ENGINEERING

| Sl. No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1. | 24IT985 | Front End Engineering | PEC | 3 | 3 | 0 | 0 | 3 |
| 2. | 24IT986 | Server-side Programming | PEC | 3 | 3 | 0 | 0 | 3 |
| 3. | 24IT987 | Microservice Architecture | PEC | 3 | 3 | 0 | 0 | 3 |
| 4. | 24IT988 | DevOps | PEC | 3 | 3 | 0 | 0 | 3 |
| 5. | 24IT989 | Capstone Design Project | EEC | 12 | 0 | 0 | 12 | 6 |
| | | | **Total** | **24** | **12** | **0** | **12** | **18** |

## MINOR DEGREE WITH SPECIALIZATION IN ENTREPRENEURSHIP AND INNOVATION

| Sl. No. | Course Code | Course Title | Category | Contact Periods | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1. | 24IT990 | Foundations of Entrepreneurship | PEC | 3 | 3 | 0 | 0 | 3 |
| 2. | 24IT991 | Team Building and Leadership Management for Business | PEC | 3 | 3 | 0 | 0 | 3 |
| 3. | 24IT992 | Creativity and Innovation in Entrepreneurship | PEC | 3 | 3 | 0 | 0 | 3 |
| 4. | 24IT993 | Principles of Marketing Management for Business | PEC | 3 | 3 | 0 | 0 | 3 |
| 5. | 24IT994 | Capstone Design Project | EEC | 12 | 0 | 0 | 12 | 6 |
| | | | **Total** | **24** | **12** | **0** | **12** | **18** |

| Course Code | MATRICES AND CALCULUS | L | T | P | C |
|---|---|---|---|---|---|
| 24MA101 | | 3 | 1 | 0 | 4 |

**OBJECTIVES:**

**The course will enable the learners to:**

- explain the concepts of matrix algebra techniques.
- understand various techniques to solve second and higher order differential equations.
- demonstrate simple applications of functions of several variables and vector calculus.
- comprehend the basic concepts of multiple integrals.
- illustrate elementary ideas of vector calculus.

**UNIT I MATRICES** **12**

Eigenvalues and Eigenvectors of a real matrix – Properties of eigenvalues and eigenvectors – Statement and applications of Cayley-Hamilton Theorem – Diagonalization of matrices by orthogonal transformation (excluding similarity transformation) – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

**UNIT II DIFFERENTIAL EQUATIONS** **12**

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

**UNIT III FUNCTIONS OF SEVERAL VARIABLES** **12**

Total derivative – Differentiation of implicit functions – Jacobian and properties – Taylor's seriesfor functions of two variables – Maxima and minima of functions of two variables– Lagrange's method of undetermined multipliers.

**UNIT IV MULTIPLE INTEGRALS** **12**

Double integrals – Change of order of integration – Area enclosed by Cartesian Coordinates (excluding polar coordinates) – Triple integrals (excluding spherical and cylindrical coordinates)
– Volume of solids (Cartesian Coordinates only).

**UNIT V VECTOR CALCULUS** **12**

Gradient, divergence and curl (excluding vector identities) – Directional derivative – Irrotational and Solenoidal vector fields – Green's theorem in a plane, Stoke's theorem and Gauss divergencetheorem (Statement only) - Simple applications involving cubes and rectangular parallelopipeds.

**TOTAL: 60 PERIODS**

**COURSE OUTCOMES:**

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

CO1: compute the matrix inverse and their higher powers.

CO2: solve second and higher order differential equations.

CO3: determine the maxima and minima of functions of two variables.

CO4: determine the volume and surface area using multiple integrals.

CO5: evaluate integrals using the concept of vector calculus.

CO6: apply matrix algebra techniques to diagonalize the matrix.

**TEXT BOOKS:**


1. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2021.


**REFERENCES:**


1. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7th Edition, New Delhi, 2015.
2. M. K. Venkataraman, "Engineering Mathematics", Volume I, 4th Edition, The National Publication Company, Chennai, 2003.
3. Sivaramakrishna Dass, C. Vijayakumari, "EngineeringMathematics", Pearson Education India, 4th Edition 2019.
4. H. K. Dass, and Er. Rajnish Verma, "Higher Engineering Mathematics", S. Chand Private Limited, 3rd Edition 2014.
5. B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, 6th Edition, New Delhi, 2008.
6. NPTEL course on "Engineering Mathematics - I", by Prof. Jitendra Kumar, IIT Kharagpur: https://onlinecourses.nptel.ac.in/noc21_ma58/preview

| Course Code | HERITAGE OF TAMILS | L | T | P | C |
|---|---|---|---|---|---|
| 24GE102 | | 1 | 0 | 0 | 1 |

**OBJECTIVES:**

**The course will enable the learners to:**

- recognize Tamil literature and its significance in Tamil culture.
- introduce the Tamils' rich artistic and cultural legacy.
- familiarize the different types of folk and martial arts that are unique to Tamil Nadu.
- acquaint the concept of Thinai in Tamil literature and culture.
- comprehend the significance of Tamil in developing Indian culture.

**UNIT I LANGUAGE AND LITERATURE 3**

Language Families in India - Dravidian Languages – Tamil as a Classical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry – Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.

**UNIT II HERITAGE - ROCK ART PAINTINGS TO MODERN ART- SCULPTURE 3**

Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making -- Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

**UNIT III FOLK AND MARTIAL ARTS 3**

Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leatherpuppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

**UNIT IV THINAI CONCEPT OF TAMILS 3**

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Citiesand Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

**UNIT V CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE 3**

Contribution of Tamils to Indian Freedom Struggle – The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement – Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

**TOTAL: 15 PERIODS**

**COURSE OUTCOMES:**

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

CO1: state the role of Tamil literature in shaping Tamil Cultural roots.

CO2: express the cultural and religious significance of Tamil art and sculptures.

CO3: identify and describe the techniques of folk and martial arts.

CO4: glassify the role of Thinai concept in Tamil culture and literature.

CO5: compare the idea of cultural and intellectual contributions of Tamils.

REFERENCE BOOKS


1. தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. Social Life of Tamils (Dr.K.K. Pillay) A joint publication of TNTB & ESC and RMRL –(in print)
5. Social Life of the Tamils - The Classical Period (Dr.S .Singaravelu) (Published by:International Institute of Tamil Studies.
6. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D.Thirunavukkarasu ) (Published by: International Institute of Tamil Studies).
7. The Contributions of the Tamils to Indian Culture (Dr. M. Valarmathi) (Published by:International Institute of Tamil Studies.)
8. Keeladi - ‘Sangam City Civilization on the banks of river Vaigai’ (Jointly Published by:
9. Department of Archaeology & Tamil Nadu Text Book and Educational ServicesCorporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr. K. K. Pillay)(Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil NaduText Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by: RMRL)

| Course Code | PROGRAMMING IN C++ (Theory Course with Laboratory Component) | L | T | P | C |
|---|---|---|---|---|---|
| 24CS101 | | 3 | 0 | 3 | 4.5 |

**OBJECTIVES:**

**The Course will enable learners to:**

- To learn problem solving and programming fundamentals.
- To gain knowledge on pointers and functions.
- To apply the principles of object orientated programming.
- To understand operator overloading, inheritance and polymorphism.
- To use the functionalities of I/O operations, files build C++ programs usingexceptions.

## UNIT I PROGRAMMING FUNDAMENTALS 9+9

Types of computer programming languages - Genesis of C++ - Program Life Cycle - Structure of C++ program - Identifiers - Variables - Keywords - Number System -Binary Number System -Octal Number System- Decimal Number System -Hexadecimal Number System - Data types - Constants - Errors – Operators- Expressions - Type Conversions - Control-Flow Statements - Conditional Statements - Iterative Statements -Unconditional Control Statements - Arrays - One-Dimensional Arrays - Two-DimensionalArrays - Multi -Dimensional Arrays - Strings - String Manipulation Functions - Array of Strings.

**List of Exercise/Experiments:**

1. Write C++ programs for the following:
    a. Find the sum of individual digits of a positive integer.
    b. Compute the GCD of two numbers.
    c. Find the roots of a number (Newton's method)
2. Write C++ programs using arrays:
    a. Find the maximum of an array of numbers.
    b. Remove duplicates from an array of numbers.
    c. Print the numbers in an array after removing even numbers.
3. Write C++ programs using strings:
    a. Checking for palindrome.
    b. Count the occurrences of each character in a given word.

## UNIT II POINTERS AND FUNCTIONS 9+9

Pointers - Pointer Variables - Pointer Operators & Expressions -Pointers with Arrays - Functions - Scope Rules -Function Arguments -return Statement - Function Variables - Storage Classes - Types of storage classes - Create Header Files - User-Defined Functions - Inline Functions - Function Overloading -Recursion - Namespaces.

**List of Exercise/Experiments:**

1. Generate salary slip of employees using structures and pointers. Create a structure Employee with the following members: EID, Ename, Designation, DOB, DOJ, Basic pay Note that DOB and DOJ should be implemented using structure within structure.

2. Compute internal marks of students for five different subjects using structures and functions.

## UNIT III CLASSES AND OBJECTS 9+9

Concepts of Object Oriented Programming – Benefits of OOP – Simple C++ program –

Classes and Objects - Member functions - Nesting of member functions - Private member functions - Memory Allocation for Objects - Static Data Members - Static Member functions - Array of Objects - Objects as function arguments - Returning objects - friend functions – Const Member functions - Constructors – Destructors.

**List of Exercise/Experiments:**

1. Write a program Illustrating Class Declarations, Definition, and Accessing ClassMembers.
2. Program to illustrate default constructor, parameterized constructor and copy constructors.

**Practice Questions & Scenario Based Questions:**

1. Imagine you are working as a software engineer at a tech company. Your team is developing a mathematical software library that will be used in various applications across the company. One of the features that your team lead has asked you to implement is a function that calculates the number of trailing zeros in the factorial ofa number.

   The team lead has emphasized the importance of encapsulation in your implementation.

2. Create a C++ class Calculator representing a simple calculator. The class should have the following attributes and methods:

   Attributes: Two operands and an operation (+, -, *, /)

   Methods: Perform the operation and return the result

   Implement constructors to initialize the calculator with default values (0,0) and with specified values. Also, implement a destructor to perform any necessary cleanup.

## UNIT IV OPERATOR OVERLOADING, INHERITANCE AND POLYMORPHISM 9+9

Operator Overloading - Overloading Using Friend functions – Inheritance – Types of inheritance – Virtual Base Class - Abstract Class – Constructors in Derived Classes - member class: nesting of classes.

Pointer to objects – this pointer- Pointer to derived Class - Virtual functions – PureVirtual Functions – Polymorphism.

**List of Exercise/Experiments:**

1. Write a Program to Demonstrate the i) Operator Overloading. ii) Function Overloading.
2. Write a Program to Demonstrate Friend Function and Friend Class.
3. Program to demonstrate inline functions.
4. Program for Overriding of member functions.
5. Write C++ programs that illustrate how the following forms of inheritance aresupported: Single inheritance b) Multiple inheritance c) Multi level inheritance d) Hierarchicalinheritance.

**Practice Questions & Scenario Based Questions:**

1. Joy is a software developer at a 3D modeling company. The company is developinga new software tool that will be used by architects and engineers to design and analyze 3D models of various structures. One of the features that her project manager has asked is to implement a function that calculates the volume of basic 3Dshapes like cylinders and cuboids. The project manager has emphasized the importance of using function overloading in her implementation..

2. Imagine you are a software developer tasked with creating a utility program for a school that handles student scores. The school wants a simple program where teachers can enter the scores of students for a particular test, and the program will then provide the highest and lowest scores among them. This will help the teachers quickly identify the top performer and the student who might need extra help.

   Your task is to write program that satisfies the above scenario using **inline function**

3. Develop a software system to manage part-time worker students at a university. These students have unique attributes such as their name, student ID, hourly wage, and hours worked per week. Your goal is to create a C++ program that models this system.

4. Ramu is a software developer at a company specializing in developing softwaresolutions for geometric shapes. Recently, a client approached with a request to create a program to calculate the areas of rectangles and triangles.

**UNIT V I/O, FILES AND EXCEPTIONS 9+9**

C++ Streams – Unformatted I/O - Formatted Console I/O – Opening and Closing File – File modes - File pointers and their manipulations – Templates – Class Templates – Function Templates - Exception handling.

**List of Exercise/Experiments:**

1. Program to demonstrate pure virtual function implementation.
2. Count the number of account holders whose balance is less than the minimumbalance using sequential access file.
3. Write a Program to Demonstrate the Catching of all Exceptions.

**Practice Questions & Scenario Based Questions:**

1. Develop a simple library management system. Create a base class Book representing a book in the library. The class should have attributes such as title, author, and ISBN (International Standard Book Number). Implement a virtual functiondisplayDetails() to display information about the book.
2. A software developer working on a banking application. One of the requirements is toanalyze account holders' balances based on a minimum balance threshold. The application should read account information from a sequential access file, where each line represents an account record in the format: account_holder_name, balance.
3. The financial company is developing a new software tool that will be used by financial analysts to perform various calculations. One of the features of that projectis to implement is a function that performs division of two numbers.

   Write a program that takes two integer inputs, numerator and denominator, from the user. Implement error handling to check if the denominator is zero. If the denominator is zero, display the message "Division by zero is not allowed!" using an

   exception. If the denominator is not zero, calculate the result of the division and display it.
4. Mini project.

**TOTAL: 45+45 = 90 PERIODS**

**OUTCOMES:**

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

**CO1:** Solve problems using basic constructs in C++.

**CO2:** Implement C++ programs using pointers and functions.

**CO3:** Apply object-oriented concepts and solve real world problems.

**CO4:** Develop C++ programs using operator overloading and polymorphism.

**CO5:** Implement C++ programs using Files and exceptions.

**CO6:** Develop applications using C++ concepts

**TEXT BOOKS:**


1. Herbert Schildt, “The Complete Reference C++”, 4th edition, MH, 2015. (Unit 1 & 2)
2. E Balagurusamy,”Object Oriented Programming with C++”, 4th Edition, TataMcGraw-Hill Education, 2008. (Unit 3, 4 & 5)


**REFERENCES:**


1. Karl Beecher,”Computational Thinking: A beginner's guide to problem-solving and programming”, BCS Learning & Development Ltd, 2017. (Unit 1)
2. Nell Dale, Chip Weems, “Programming and Problem Solving with C++”, 5th Edition,Jones and Barklett Publishers, 2010.
3. John Hubbard, “Schaum's Outline of Programming with C++”, MH, 2016.

4. Yashavant P. Kanetkar, “Let us C++”, BPB Publications, 2020
5. ISRD Group, “Introduction to Object-oriented Programming and C++”, Tata McGraw-Hill Publishing Company Ltd., 2007.
6. D. S. Malik, “C++ Programming: From Problem Analysis to Program Design”, ThirdEdition, Thomson Course Technology, 2007.
https://infyspringboard.onwingspan.com/web/en/app/toc/
lex_auth_01297200240671948837_shared/overview

**LIST OF EQUIPMENTS:**

1. Standalone desktops with C/C++ compiler (or) Server with C/C++ compiler.

| Course Code | SOFTWARE DEVELOPMENT PRACTICES (Theory Course with Laboratory Component) | L | T | P | C |
|---|---|---|---|---|---|
| 24CS102 | | 3 | 0 | 3 | 4.5 |

**OBJECTIVES:**

**The Course will enable learners to:**

- discuss the essence of agile development methods.
- set up and create a GitHub repository.
- create interactive websites using HTML
- design interactive websites using CSS.
- develop dynamic web page using Java script.

**UNIT I AGILE SOFTWARE DEVELOPMENT AND Git and GitHub 9+9**

Software Engineering Practices – Waterfall Model - Agility – Agile Process – Extreme Programming - Agile Process Models – Adaptive Software Development – Scrum – Dynamic Systems Development Method – Crystal – Feature Driven Development – Lean Software Development – Agile Modeling – Agile Unified Process – Tool set for Agile Process.

Introduction to Git –Setting up a Git Repository - Recording Changes to the Repository - Viewing the Commit History - Undoing Things - Working with Remotes -Tagging - Git Aliases - Git Branching - Branches in a Nutshell - Basic Branching and Merging - Branch Management - Branching Workflows - Remote Branches - Rebasing.

Introduction to GitHub – Set up and Configuration - Contribution to Projects, Maintaining a Project – Scripting GitHub.

**List of Exercise/Experiments:**

1. Form a Team, Decide on a project:
    a) Create a repository in GitHub for the team.
    b) Choose and follow a Git workflow
        - Each team member can create a StudentName.txt file with contents about themselves and the team project
        - Each team member can create a branch, commit the file with a proper commit message and push the branch to remote GitHub repository.
        - Team members can now create a Pull request to merge the branch to master branch or main development branch.
        - The Pull request can have two reviewers, one peer team member and one faculty. Reviewers can give at least one comment for Pull Request updating.
        - Once pull request is reviewed and merged, the master or main development branch will have files created by all team members.

2. Create a web page with at least three links to different web pages. Each of the web pages is to be designed by a team member. Follow Git workflow, pull request and peer reviews.

3. Form a Team, Decide on a project:
    c) Create a repository in GitHub for the team.
    d) Choose and follow a Git workflow
        - Each team member can create a StudentName.txt file with contents about themselves and the team project
        - Each team member can create a branch, commit the file with a proper commit message and push the branch to remote GitHub repository.
        - Team members can now create a Pull request to merge the branch to master branch or main development branch.
        - The Pull request can have two reviewers, one peer team member and one faculty. Reviewers can give at least one comment for Pull Request updation.
        - Once pull request is reviewed and merged, the master or main development branch will have files created by all team members.
4. Create a web page with at least three links to different web pages. Each of the web pages is to be designed by a team member. Follow Git workflow, pull request and peer reviews.

**UNIT II HTML 9+9**

Introduction – Web Basics – Multitier Application Architecture – Cline-Side Scripting versus Server-side Scripting – HTML5 – Headings – Linking – Images – Special Characters and Horizontal Rules – Lists – Tables – Forms – Internal Linking – meta Elements – Form input Types – input and datalist Elements – Page-Structure Elements.

**List of Exercise/Experiments:**

1. Create web pages using the following:
    - Tables and Lists
    - Image map
    - Forms and Form elements
    - Frames

**UNIT III CSS 9+9**

Inline Styles – Embedded Style Sheets – Conflicting Styles – Linking External Style Sheets – Positioning Elements – Backgrounds – Element Dimensions – Box Model and Text Flow – Media Types and Media Queries – Drop-Down Menus – Text Shadows – Rounded Corners – Colour – Box Shadows – Linear Gradients – Radial Gradients – Multiple Background Images – Image Borders – Animations – Transitions and Transformations – Flexible Box Layout Module – Multicolumn Layout.

**List of Exercise/Experiments:**

1. Apply Cascading style sheets for the web pages created.

**UNIT IV JAVASCRIPT BASICS 9+9**

Introduction to Scripting – Obtaining user input – Memory Concepts – Arithmetic – Decision Making: Equality and Relational Operators – JavaScript Control Statements – Functions – Program Modules – Programmer-defined functions – Scope rules – functions – Recursion – Arrays – Declaring and Allocating Arrays – References and Reference Parameters – Passing Arrays to Functions – Multidimensional arrays.

**List of Exercise/Experiments:**

1. Form Validation (Date, Email, User name, Password and Number validation) using JavaScript.

**UNIT V JAVASCRIPT OBJECTS 9+9**

Objects – Math, String, and Date, Boolean and Number, document Object – Using JSON to Represent objects – DOM: Objects and Collections – Event Handling.

**List of Exercise/Experiments:**

Implement Event Handling in the web pages.

**Mini Projects**-Develop any one of the following web applications (not limited to one) using above technologies.

a. Online assessment system
b. Ticket reservation system
c. Online shopping
d. Student management system
e. Student result management system
f. Library management
g. Hospital management
h. Attendance management system
i. Examination automation system
j. Web based chat application

**TOTAL: 45+45=90 PERIODS**

**OUTCOMES:**

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

**CO1:** Understand basic software engineering practices effectively.

**CO2:** Apply version control using Git and GitHub, and manage code repositories proficiently.

**CO3:** Design web applications using HTML, CSS, and JavaScript.

**CO4:** Analyze problems and create solutions using CSS for better web page presentation and usability.

**CO5:** Develop interactive web pages using JavaScript with an event-handling mechanism.

**CO6:** Apply the technological changes and improve skills continuously.

**TEXT BOOKS:**


1. Roger S. Pressman, "Software Engineering: A Practitioner„s Approach", McGraw Hill International Edition, Nineth Edition, 2020.

2. Scott Chacon, Ben Straub, "Pro GIT", Apress Publisher, 3rd Edition, 2014.
   Deitel and Deitel and Nieto, "Internet and World Wide Web - How to Program", Pearson, 5th Edition, 2018.


**REFERENCES:**


1. Roman Pichler, "Agile Product Management with Scrum Creating Products that Customers Love", Pearson Education, 1 st Edition, 2010.
2. Jeffrey C and Jackson, "Web Technologies A Computer Science Perspective", Pearson Education, 2011.
3. Stephen Wynkoop and John Burke, "Running a Perfect Website", QUE, 2nd Edition, 1999.
4. Chris Bates, "Web Programming – Building Intranet Applications", 3rd Edition, Wiley Publications, 2009.
5. Gopalan N.P. and Akilandeswari J., "Web Technology", Second Edition, Prentice Hall of India, 2014.
6. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013382690411003904735_shared/overview
7. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013094421427470336209 9_shared/overview


**LIST OF EQUIPMENTS:**

1. Systems with either Netbeans or Eclipse
2. Java/JSP/ISP Webserver/Apache
3. Tomcat / MySQL / Dreamweaver or
4. Equivalent/ Eclipse, WAMP/XAMP

| Course Code | ENGINEERING CHEMISTRY (Theory Course with Laboratory Component) | L | T | P | C |
|---|---|---|---|---|---|
| 24CH101 | | 3 | 0 | 2 | 4 |

**OBJECTIVES:**

**The course will enable the learners**

- To gain a comprehensive knowledge on polymers utilized in various industrial sectors.
- To acquire knowledge on the fundamental principles of energy storage devices.
- To gain insights into the basic concepts and applications of chemical sensors and cheminformatics.
- To identify the different types of smart materials and explore their applications in Engineering and Technology.
- To assimilate the preparation, properties and applications of nanomaterials in various fields.

**UNIT I INDUSTRIAL POLYMERS** **15**

Polymers: Terminology – functionality, degree of polymerization, properties – glass transition temperature and molecular weight (weight average method).

Engineering plastics: preparation, properties and application of Polyethylene, Teflon, Polyethylene terephthalate and Epoxy resin- industrial applications of Polyethylene and Polyethylene terephthalate in packaging.

Special polymers: preparation, properties and applications of piezoelectric polymer - Polyvinylidene fluoride, electroactive polymer-Polyacetylene and biodegradable polymer - Polylactic acid .

(Theory-9)

1. Determination of the molecular weight of polymer using viscometer.
2. Determination of degradation of biodegradable polymer using photoreactor.
3. Demonstrate the applications of biodegradable plastic using 3D printing.

(Laboratory-6)

**UNIT II ENERGY STORAGE DEVICES AND GREEN FUEL** **15**

Introduction to Electrochemical cell and its terminology - electrochemical series and its applications.

Batteries: classification - construction and working principle -primary alkaline battery - secondary battery - Pb-acid battery.

Green fuel – Hydrogen - production (Photo electrocatalytic and photo catalytic water splitting), construction, working principle and applications in $H_2$ -$O_2$ fuel cells.

Batteries used in E- vehicle: Ni-metal hydride battery, Li-ion Battery - recycling of Li-ion batteries by direct cycling method; environmental effects of different energy storage devices.

(Theory-9)

1. Construction of electrochemical cell.
2. Determination of discharging state of Pb-acid battery by estimating the strength of the acid correlates with specific gravity.
3. Study of performance of a battery using battery analyzing module.

(Laboratory-6)

**UNIT III CHEMICAL SENSORS AND CHEMINFORMATICS 15**

Introduction: classification of chemical sensors -principle, construction and working of chemical sensors; pH sensor – Glass electrode; Breath analyzer; Industrial sensor – $CO_2$ sensors- Sensor for health care – Glucose sensor.

Cheminformatics: definition, scope, and significance; applications in the environmental sector – carbon footprint measurements, data analysis and interpretation.

(Theory-9)

1. Determination of the amount of given hydrochloric acid using a pH meter.
2. Calculate the carbon footprint from the provided dataset, analyze the results and draw conclusions.

(Laboratory-6)

**UNIT IV SMART MATERIALS 15**

Shape Memory Alloys: introduction - shape memory effect – functional properties of SMAs – types of SMA - Nitinol (Ni-Ti) alloys and its applications.

Chromogenic materials: introduction – types, applications in chemical and biological detection, display technologies, smart windows and light- modulating devices, biomedical and healthcare.

Smart Hydrogels: Introduction - Super Absorbent Polymers (SAP) - preparation, properties and applications of polyacrylic acid and sodium polyacrylate

(Theory-9)

1. Demonstrate the shape memory effect using Nitinol wire.
2. Determination of pH sensitivity of bromothymol blue.
3. Determination of absorption efficiency of hydrogel by using kinetic study.

(Laboratory-6)

**UNIT V NANO CHEMISTRY 15**

Introduction – synthesis – top-down process (laser ablation, chemical vapor deposition), bottom-up process (precipitation, electrochemical deposition) - properties of nanomaterials – types –

nanotubes -carbon nanotubes, applications of CNT - nanocomposites – general applications of nanomaterials in electronics, information technology, medical and healthcare, energy, environmental remediation, construction and transportation industries.

(Theory-9)

1. Preparation of nano $BaSO_4$ by precipitation method.
2. Demonstrate the efficiency of nano adsorbents in polluted water.

(Laboratory-6)

**TOTAL: 75 PERIODS**

**COURSE OUTCOMES:**

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

CO1: To examine the role of polymers in different industrial sectors.

CO2: To identify the suitability of batteries for various fields.

CO3: To apply the fundamental principles of chemical sensors, cheminformatics and their applications across various industries.

CO4: To analyze the types of smart materials used in various engineering fields.

CO5: To explore the applications of nanomaterials in various fields, considering their advantages and limitations.

CO6: To integrate the concepts of chemistry for various engineering applications.

**TEXTBOOKS:**


1. P. C. Jain and Monika Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company Pvt. Ltd., New Delhi, 19th Edition, 2024.
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2nd reprint, 2012.


**REFERENCES:**


1. S.S. Dara and S.S. Umare, "A Textbook of Engineering Chemistry,S. Chand &company, New Delhi, 12th Edition, 2022.
2. V.R. Gowarikar, Polymer Science, New Age International Publishers, 4th edition,2021.
3. J. C. Kuriacose and J. Rajaram, "Chemistry in Engineering and Technology", Volume -1 & Volume -2, Tata McGraw-Hill Education Pvt. Ltd., 2010.
4. Barry A. Bunin, Brian Siesel, and J. Bajorath, "Chemoinformatics: Theory, Practice, & Products", Springer, First Edition, 2007.
5. Geoffrey A. Ozin, Andre C. Arsenault and Ludovico Cademartiri, "Nanochemistry: A Chemical Approach to Nanomaterials", RSC publishers, 2nd Edition, 2015.

6. J. Mendham, R. C. Denney, J. D. Barnes, M. J. K. Thomas and B. Sivasankar, "Vogel's Quantitative Chemical Analysis", Pearson Education Pvt. Ltd., 6th edition, 2019.

7. NPTEL course on "Polymers: concepts, properties, uses and sustainability" Prof. Abhijit P Deshpande, IIT-Madras, https://onlinecourses.nptel.ac.in/noc20_ch41/preview
8. NPTEL course on "Electrochemical Energy Storage" Prof. Subhasish Basu Majumder, IIT Kharagpur, https://onlinecourses.nptel.ac.in/noc21_mm34/preview

9. NPTEL course on "Nanotechnology, Science and Applications" Prof. Prathap Haridoss, IIT-Madras, https://onlinecourses.nptel.ac.in/noc22_mm33/preview

**LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS**

| S. No. | Description of Equipment | Quantity |
|---|---|---|
| 1. | Conductivity meter | 12 Nos. |
| 2. | pH meter | 12 Nos. |
| 3. | UV-Visible Spectrophotometer | 2 Nos. |
| 4. | Potentiometer | 12 Nos. |
| 5. | CAN Enabled BMS unit | 4 Nos. |
| 6. | Photoreactor | 2 Nos. |

| Course Code | DIGITAL PRINCIPLES AND SYSTEM DESIGN (Theory Course with Laboratory Component) | L | T | P | C |
|---|---|---|---|---|---|
| 24EC102 | | 3 | 0 | 2 | 4 |

**OBJECTIVES:**

**The Course will enable learners to:**

- acquire the knowledge in Digital fundamentals and its simplification methods.
- familiarize the design of various combinational digital circuits using logic gates.
- realize various sequential circuits using flip flops.
- elucidate various semiconductor memories and related technology.
- build various logic functions using Programmable Logic Devices

## UNIT I BOOLEAN ALGEBRA AND LOGIC GATES 9

Review of number systems-representation-conversions, Review of Boolean algebra theorems, sum of product and product of sum simplification, canonical forms, min term and max term, Simplification of Boolean expressions-Karnaugh map, Implementation ofBoolean expressions using logic gates and universal gates.

**List of Exercise/Experiments:**

1. Implementation of Boolean expression using logic gates.

## UNIT II COMBINATIONAL LOGIC CIRCUITS 9

Design of combinational circuits - Half and Full Adders, Half and Full Subtractors, BinaryParallel Adder – Carry look ahead Adder, Magnitude Comparator, Decoder, Encoder, Priority Encoder, Mux/De-mux, Parity Generator/Checker

**List of Exercise/Experiments:**

2. Design of adders
3. Design of subtractors.
4. Design of binary adder using IC7483
5. Design of Multiplexers & Demultiplexers.
6. Design of Encoders and Decoders.
7. Implementation of a boolean function using a multiplexer

**UNIT III SEQUENTIAL CIRCUITS 9**

Flip flops – SR, JK, T, D, Master/Slave FF – operation and excitation tables, Asynchronous and Synchronous Counters Design - Shift registers, Universal Shift Register

**List of Exercise/Experiments:**

8. Design and implementation of 3 bit ripple counters.
9. Design and implementation of 3 bit synchronous counter
10. Design and implementation of shift registers

**UNIT IV SYNCHRONOUS SEQUENTIAL CIRCUITS DESIGN 9**

Design of clocked sequential circuits - Moore/Mealy models, state minimization, state assignment, circuit implementation

**UNIT V MEMORY AND PROGRAMMABLE LOGIC DEVICES 9**

Basic memory structure ROM: PROM – EPROM – EEPROM –RAM – Static anddynamic RAM – Programmable Logic Devices: Programmable Logic Array (PLA) – Programmable Array Logic (PAL) – Implementation of combinational logic circuits using PLA, PAL.

**TOTAL: 45 PERIODS (THEORY) + 30 PERIODS (LAB) = 75 PERIODS**

**COURSE OUTCOMES:**

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

CO1: Apply Boolean algebra to simplify and implement digital circuits.

CO2: Design combinational circuits to meet specific functional requirements using logic gates.

CO3: Demonstrate the operation of counters and shift registers using flip-flops in sequential circuits.

CO4: Analyze synchronous sequential circuits to determine their behavior and performance characteristics.

CO5: Evaluate various types of memory devices, discussing their roles and functionalities in digital systems.

CO6: Construct combinational circuits using Programmable Logic Devices (PLDs) to solve complex digital design problems.

**TEXTBOOKS:**


1. M. Morris Mano and Michael D. Ciletti, Digital Design, With an Introduction tothe Verilog HDL, VHDL, and System Verilog, 6th Edition, Pearson, 2018.
2. S.Salivahanan and S.Arivazhagan,Digital Circuits and Design, 5th Edition, Oxford University Press, 2018.


**REFERENCES:**


1. A.Anandkumar, Fundamental of digital circuits, 4th Edition, PHI Publication,2016.
2. WilliamKleitz, Digital Electronics-A Practical approach to VHDL, Prentice Hall International Inc, 2012.
3. CharlesH.Roth, Jr. andLarry L. Kinney, Fundamentals of Logic Design, 7th Edition,Thomson Learning, 2014.
4. Thomas L. Floyd, Digital Fundamentals, 11th Edition, Pearson Education Inc, 2017.John.M Yarbrough, Digital Logic: Applications and Design, 1st Edition, Cengage India,2006


**NPTEL LINK:**

https://nptel.ac.in/courses/108105132

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

IC Trainer Kit -15 Nos

ICs each - 30 Nos ( 7400/ 7404 / 7486 / 7408 / 7432 / 7483 / 7473 / 7411/7474)

| Course Code | STUDENT INDUCTION PROGRAM (SIP) | L | T | P | C |
|---|---|---|---|---|---|
| 24MC101 | | 3 Weeks | | | |

**OBJECTIVES**

**The course will enable the learners to:**

- Facilitate the adjustment of new students to the new environment, ensuring they feel comfortable and supported.
- Inculcate the institution's ethos and culture in new students, helping them internalize these values.
- Encourage the building of bonds among students and between students and faculty members.
- Expose students to a sense of larger purpose and guide them in their journey of self-exploration.

The various modules or core areas recommended for the 3-week SIP are

**Module 1: Universal Human Values I** **18**

Welcome and Introductions - Aspirations and Concerns - Self- Management - Health - Relationships - Society - Natural Environment - Sum Up - Self-evaluation and Closure.

**Module 2: Physical Health and Related Activities** **6**

Special Lecturers: Happy and Healthy lifestyle - Physical Health -Mental Health - Health and Fitness.

**Module 3: Familiarization of Department/ Branch and Innovation** **8**

Principal Address - Address by Head of Science and Humanities - Addresses by Respective Department HoDs – Campus Tour – CoE introduction – Introduction of Student Activity Cell (SAC).

**Module 4: Visit to a Local Area** **4**

Virtual tour: Government Museum - Theosophical Society - Fort St. George - Ripon Building - Kalakshetra Foundation - Anna Centenary Library - Marina Beach - St. Thomas Mount - Vivekananda House**.**

**Module 5: Lectures by Eminent People** **10**

Special Lecturers: Academics – industry – Careers – Art - Self-management.

**Module 6: Proficiency Modules** **30**

Basic Competencies: C Programming, Foundation in Mathematics, Interpersonal Communication.

**Module 7: Literature / Literary Activities** **7**

Literary Debate - Creative Writing Workshop - Literature Circle Discussions - Author Study and Presentation.

**Module 8: Creative Practices** **10**

Activity: Handicrafts (Painting / Drawing / Pottery / Knitting / Jewellery making, etc.)

**Module 9: Extra Curricular Activities** **10**

Students Activity Cell: Activities from Coding Club – Math Club -- Language Club - AstronomyClub - ECO Club - Photography Club - Tedx Club -Yoga Club.

**Valedictory and Closing Ceremony** **2**

**TOTAL: 105 PERIODS**

## COURSE OUTCOMES

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

- Achieve a smooth transition where students feel comfortable and confident in their new environment.
- Demonstrate a strong understanding and practice of the institution's ethos and culture within the campus community.
- Build meaningful and supportive relationships with peers and faculty members.
- Develop a clear sense of purpose and engage in self-exploration, leading to a deeper understanding of personal goals and aspirations.

## REFERENCE:

**https://www.aicte-india.org/sites/default/files/Detailed%20Guide%20on%20Student%20Induction%20program.pdf**

| Course Code | INTERPERSONAL SKILLS, PSYCHOMETRIC ANALYSIS AND CAREER DEVELOPMENT | L | T | P | C |
|---|---|---|---|---|---|
| 24HS111 | | 1 | 0 | 0 | 1 |

**OBJECTIVES**

**The course will enable the learners to:**

- Evaluate and enhance language proficiency by using SMART Vox to assess communication skills and linguistic abilities.
- Explore future technologies, solve real-time problems, and prepare students for campus recruitment.
- Assess and develop work style, cognitive abilities, emotional intelligence, and work competencies
- Explore placements, internships, higher education options, GATE and CAT exams, and career development.
- Understand career milestones, assess personal skills and personality, and develop effective goal-setting strategies for successful career planning

**UNIT I LANGUAGE PROFICIENCY EVALUATION 3**

Identification of Strengths and Weaknesses - Assessing Language Skills (Diagnostic tests and interactive exercises) - Measuring Language Competence (Proficiency Levels) - Identifying Support Needs - Developing Individual Learning Plans - Enhancing Student Experience (Building Confidence) – Evaluation using SMART Vox

**UNIT II CAREER GUIDANCE 3**

Future of Engineering- Various aspects of Technology and its Applications - Future of Technologies – Branch Specific emerging technologies - Problems solving through open source - Campus recruitment process.

**UNIT III PSYCHOMETRIC EVALUATION 3**

Understanding Behavioural work style (Personality)- Testing of numerical, logical, and verbal reasoning skills (Cognitive Abilities / Aptitude) – Measure of emotional intelligence and interpersonal skills – Determination of Culture Preferences in various workplace scenarios – Evaluation of Work Competencies through targeted games and simulations

**UNIT IV CAREER PREPARATION 3**

Present Scenario of Engineering - Placement Opportunities - Internship Opportunities - Types of Internships- Higher Education opportunities in India and Abroad - Understanding GATE and CAT Exams - Other Opportunities - Career path development plans.

**UNIT V CAREER VISION AND PLANNING** **3**

Introduction to career milestones - Overview of the Vision Assessment and its benefits - Psychometric evaluation - Numeracy, Literacy, Visual Reasoning, Algorithmic Thinking - Introduction to a goal-setting model - Identification career pathways aligned with personality profiles - Evaluate personal skills and abilities in various areas.

**COURSE OUTCOMES** **TOTAL: 15 PERIODS**

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

**CO1**: Assess and improve their English language proficiency using SMART Vox, gaining insights into their communication skills and linguistic competence

**CO2**: Understand future engineering trends, emerging technologies, importance of solving real-time problems, and the process of campus recruitment.

**CO3:** Evaluate their behavioral work style, cognitive abilities, emotional intelligence, cultural preferences, and work competencies.

**CO4**: Understand the current engineering landscape, placement opportunities, and higher education prospects to develop effective career path plans

**CO5**: Develop a clear and actionable vision for their future career path.

| Course Code | IDEA LAB – I | L | T | P | C |
|---|---|---|---|---|---|
| 24GE111 | | 0 | 0 | 1 | 0 |

The students may be grouped into 3 to 4. The device/Machine/system/component are studied by the students and a final presentation to be done by the students about the study of various devices or machinery at the end of the semester.

**OBJECTIVES:**
**Students completing this course are expected to**

- Understand the functionalities and limitation of various machines/equipment
- Demonstrate various operations that can be performed using various machines

**LIST OF EXPERIMENTS**

1. Study of fundamental operations of 3D Printer and Scanner with Software.
2. Study of Laser cutting machine.
3. Study of CNC Router machine.
4. Study of Fundamentals of basic circuit design, Soldering and Desoldering.
5. Study of PCB Milling Machine.

**OTAL: 15 PERIODS**

**OUTCOMES**
**After successful completion of the course the students will be able to**

CO1 Describe the working of the 3D Printer.

CO2 Explain the operation of the CNC router and laser cutting machines.

CO3 Explain the basic parts and PCB fabrication process.

CO4 Develop the ability to handle delicate electronic components carefully, minimizing damage during the soldering process.

CO5 Describe the process for converting ideas into prototypes.

## LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

| S.No | Equipment Name | Quantity |
|---|---|---|
| 1 | CNC Router | 1 No |
| 2 | 3D Printer | 1 No |
| 3 | 3D Scanner | 1 No |
| 4 | Laser cutting Machine | 1 No |
| 5 | Multimeter | 5 Nos |
| 6 | Solder Stations | 5 Sets |
| 7 | Desoldering Machine | 1 No |
| 8 | PCB Milling Machine | 1 No |
| 9 | Variable Power Supply | 1 No |
| 10 | Electronic Components like Resistors, Transistors, Diode, Inductor, Capacitor, etc. | 5 Sets |

| Course Code | TAMILS AND TECHNOLOGY | L | T | P | C |
|---|---|---|---|---|---|
| 24GE201 | | 1 | 0 | 0 | 1 |

**OBJECTIVES:**

**The course will enable the learners to:**

- recognize the historical significance of weaving and pottery technologies in ancient Tamil civilization.
- highlight the concepts of design and construction technology during the Sangam age.
- provide an overview of manufacturing technology and its role in Tamil society.
- illustrate the agricultural and irrigation techniques employed in ancient Tamil society.
- promote scientific Tamil and Tamil computing.

**UNIT I WEAVING AND CERAMIC TECHNOLOGY 3**

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

**UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY 3**

Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram – Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

**UNIT III MANUFACTURING TECHNOLOGY 3**

Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting,steel -Copper and gold-Coins as source of history - Minting of Coins – Beads making-industries Stone beads - Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram.

**UNIT IV AGRICULTURE AND IRRIGATION TECHNOLOGY 3**

Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.

**UNIT V SCIENTIFIC TAMIL & TAMIL COMPUTING 3**

Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.

**TOTAL: 15 PERIODS**

**COURSE OUTCOMES:**

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

**CO1**: identify the role of weaving and ceramic technology in ancient Tamil Culture.
**CO2**: assess the design and construction technology ideas in the current Tamil society.
**CO3**: identify the different types of manufacturing technology used in Tamil society and their significance.
**CO4**: classify agricultural and irrigation technologies in ancient Tamil society and its current relevance.
**CO5**:discuss the fundamentals of scientific Tamil and Tamil computing.

**REFERENCE BOOKS**


1. தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. Social Life of Tamils (Dr.K.K. Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
5. Social Life of the Tamils - The Classical Period (Dr.S .Singaravelu) (Published by: International Institute of Tamil Studies.
6. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D.Thirunavukkarasu ) (Published by: International Institute of Tamil Studies).
7. The Contributions of the Tamils to Indian Culture (Dr. M. Valarmathi) (Published by: International Institute of Tamil Studies.)
8. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by:
9. Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr. K. K. Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by: RMRL).

| Course Code | LINEAR ALGEBRA AND APPLICATIONS (Theory Course with Laboratory Component) | L | T | P | C |
|---|---|---|---|---|---|
| 24MA201 | | 3 | 0 | 2 | 4 |

**OBJECTIVES:**

**The course will enable the learners to:**

- comprehend the fundamental concepts of matrices.
- illustrate the basic notions associated with vector spaces and its properties.
- utilize the Gram-Schmidt ortho normalization process.
- understand the components and implications for vector spaces by rank-nullity dimension theorem.
- calculate the eigenvalues and eigenvectors of linear transformations.

**UNIT I MATRICES AND SYSTEM OF LINEAR EQUATIONS 15**

Matrices – Row echelon form – Rank of a matrix – System of linear equations – Consistency – Gauss elimination method – Gauss Jordan method.

**Experiments using C language:**

1. Solve the system of equations using Gauss Elimination method. 2. Solve the system of equations using Gauss Jordan method.

**UNIT II VECTOR SPACES 15**

Real and Complex fields – Vector spaces over Real and Complex fields – Subspace – Linear space – Linear independence and dependence (Statement only) – Bases and dimensions.

**Experiments using C language:**

1. Check whether the given vectors are linearly independent or not. 2. Find the basis and dimension for given vectors.

**UNIT III INNER PRODUCT SPACES 15**

Inner product space and norms – Properties – Orthogonal, Orthonormal vectors – Gram- Schmidt ortho normalization process – Least squares approximation.

**Experiments using C language:**

1. Find the orthogonal vectors using inner product. 2. Find the orthonormal vectors using inner product.

**UNIT IV LINEAR TRANSFORMATION 15**

Linear transformation – Range and null space – Rank and nullity – Rank nullity Dimension theorem – Matrix representation of linear transformation – Eigenvalues and eigenvectors of linear transformation.

**Experiments using C language:**

1. Find the Rank and Nullity of a matrix.
2. Find the eigenvalues and eigenvectors of a matrix.

**UNIT V EIGENVALUE PROBLEMS AND MATRIX DECOMPOSITION 15**

Eigenvalue problems – Power method – Jacobi method – Singular value decomposition – QR decomposition.

**Experiments using C language:**

1. Solve the system of equations using Jacobi method.
2. Find QR decomposition of a matrix.

**TOTAL: 75 PERIODS**

**COURSE OUTCOMES:**

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

CO1: solve the system of linear equations using Gauss elimination and Gauss Jordan method.

CO2: analyze vector spaces to determine their bases and dimensions.

CO3: apply Gram-Schmidt process to ortho normalize sets of vectors.

CO4: apply rank nullity theorem to analyse linear transformations.

CO5: compute the eigenvalues and eigenvectors using singular value decomposition.

CO6: understand the ideas of least squares approximations and its applications.

**TEXT BOOKS:**

1. A.H. Friedberg, A. J. Insel, and L. Spence, “Linear Algebra”, Prentice Hall of India, 5th Edition, New Delhi, 2008.
2. Steven J. Leon, “Linear Algebra with Applications”, Pearson Educational International”, 9th Edition, United States of America, 2015.

**REFERENCES:**

1. G. Strang, “Linear Algebra and its applications”, Thomson (Brooks / Cole), 4th Edition, New Delhi, 2005.
2. C.F. Gerald and P.O. Wheatley, “Applied Numerical Analysis”, 7th Edition, Pearson Education, New Delhi, 2004.
3. Richard Branson, “Matrix Operations”, Schaum's outline series, 1989.
4. Bernard Kolman, R. David R. Hill, “Introductory Linear Algebra”, Pearson Educations, New Delhi, First Reprint, 2009.
5. S. Kumaresan, “Linear Algebra - A geometric approach”, Prentice Hall of India, New Delhi, Reprint, 2010.
6. NPTEL course on "Linear Algebra", by Prof. K. C. Sivakumar, IIT Madras: https://archive.nptel.ac.in/courses/111/106/111106051/#

| Course Code | DATA STRUCTURES | L | T | P | C |
|---|---|---|---|---|---|
| 24CS201 | (Theory Course with Laboratory Component) | 3 | 0 | 3 | 4.5 |

**OBJECTIVES:**

**The Course will enable learners to:**

- understand the concepts of List ADT.
- learn linear data structures – stacks and queues ADTs.
- understand and apply Tree data structures.
- understand and apply Graph structures.
- analyze sorting, searching and hashing algorithms.

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

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

**List of Exercise/Experiments:**

- Array implementation of List ADTs.
- Linked list implementation of List ADTs.

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

Stack ADT – Stack Model - Implementations: Array and Linked list - Applications - Balancing symbols - Evaluating arithmetic expressions - Conversion of Infix to postfix expression - Queue ADT – Queue Model - Implementations: Array and Linked list - applications of queues - Priority Queues – Binary Heap – Applications of Priority Queues.

**List of Exercise/Experiments:**

- Array implementation of Stack and Queue ADTs.
- Linked list implementation of Stack and Queue ADTs.
- Applications of List – Polynomial manipulations
  Applications of Stack – Infix to postfix conversion and expression evaluation.

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

Tree ADT – tree traversals - Binary Tree ADT – expression trees – applications oftrees – binary search tree ADT– AVL Tree.

**List of Exercise/Experiments:**

- Implementation of Binary Trees and operations of Binary Trees.
- Implementation of Binary Search Trees.
  Implementation of Heaps using Priority Queues.

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

Definition – Representation of Graph – Types of graph - Breadth-first traversal - Depth-first traversal – Topological Sort – Applications of graphs – BiConnectivity – Euler circuits.

**List of Exercise/Experiments:**

- Graph representation and Traversal algorithms.

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

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

**List of Exercise/Experiments:**

- Implement searching and sorting algorithms.

**TOTAL: 45+45=90 PERIODS**

**OUTCOMES:**

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

**CO1:** Analyze algorithms and abstract data types (ADTs).

**CO2:** Evaluate fundamental data structures.

**CO3:** Implement linked data structures and its application.

**CO4:** Apply advanced tree data structures.

**CO5:** Understand basic graph theory concepts.

**CO6:** Evaluate various searching and sorting algorithms.

**TEXTBOOKS:**


1. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C++”, 4th Edition,Pearson Education, 2014.
2. Sartaj Sahni, “Data Structures, Algorithms and Applications in C++”, Silicon paperpublications, 2004.


**REFERENCES:**


1. Rajesh K. Shukla, “Data Structures using C and C++”, Wiley India Publications,2009.
2. Narasimha Karumanchi, “Data Structure and Algorithmic Thinking with Python:Data Structure and Algorithmic Puzzles”, CareerMonk Publications, 2020.
3. Jean-Paul Tremblay and Paul Sorenson, “An Introduction to Data Structures with Application”, McGraw-Hill, 2017.
4. Mark Allen Weiss, “Data Structures and Algorithm Analysis in Java”, Third Edition,Pearson Education, 2012.
5. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, “Fundamentals of Data Structures in C”, Second Edition, University Press, 2008.
6. Ellis Horowitz, Sartaj Sahni, Dinesh P Mehta, “Fundamentals of Data Structures inC++”, Second Edition, Silicon Press, 2007.
7. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013501578165051392105 84/ overview


**LIST OF EQUIPMENTS:**

1. Systems with Linux/Ubuntu Operating System with gnu C++ compiler

| Course Code | JAVA PROGRAMMING | L | T | P | C |
|---|---|---|---|---|---|
| 24CS202 | (Theory Course with Laboratory Component) | 3 | 0 | 3 | 4.5 |

**OBJECTIVES:**

**The Course will enable learners to:**

- explain object oriented programming concepts and fundamentals of Java
- apply the principles of packages, interfaces and exceptions
- develop a Java application with I/O streams, threads and generic programming
- build applications using strings and collections.
- apply the JDBC concepts

**UNIT I JAVA FUNDAMENTALS 9+9**

An Overview of Java - Data Types, Variables, and Arrays – Operators - Control Statements – Class Fundamentals – Declaring objects – Methods – Constructors – thiskeyword – Overloading methods - Overloading constructors - Access Control – Static –Final

**List of Exercise/Experiments:**

1. Develop a Java application to generate Electricity bill. You must use one super classcalled EB Bill and must have two sub classes namely Domestic Bill and Commercial Bill. Create a class with the following members: Consumer no., consumer name, previous month reading, current month reading, type of EB connection (i.e domestic or commercial). Compute the bill amount using the following tariff
   If the type of the EB connection is domestic, calculate the amount to be paid asfollows: First 100 units - Rs. 1 per unit
   101-200 units - Rs. 2.50 per unit 201 -500 units - Rs. 4 per unit ,> 501 units - Rs. 6 per unit
   If the type of the EB connection is commercial, calculate the amount to be paid asfollows: First 100 units - Rs. 2 per unit ,101-200 units - Rs. 4.50 per unit 201 -500 units - Rs. 6 per unit, 501 units - Rs. 7 per unit
2. Arrays Manipulations: (Use Methods for implementing these in a Class)
   - Find kth smallest element in an unsorted array
   - Find the sub array with given sum
   - Matrix manipulations – Addition, Subtraction, Multiplication
   - Remove duplicate elements in an Array
   - Accept an integer value N and print the Nth digit in the integer sequence 1, 2, 3,4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15 and so on till infinity.

   Example: The 11th digit in the sequence 12345678910111213…. is 0.

**UNIT II INHERITANCE, INTERFACES AND EXCEPTION HANDLING 9+9**

Inheritance: Inheritance basics, Using super, Method Overriding, Using Abstract Classes, Using final with Inheritance - Package and Interfaces: Packages, Packages and member access, Importing Packages, Interfaces, Static Methods in an Interface – Exception Handling: Exception- Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built-in Exceptions.

**List of Exercise/Experiments:**

1. Develop a Java application to implement currency converter (Dollar to INR, EUROto INR, Yen to INR and vice versa), distance converter (meter to KM, miles to KM andvice versa), time converter (hours to minutes, seconds and vice versa) using packages.
2. Develop a Java application with Employee class with Emp_name, Emp_id, Address,Mail_id, Mobile_no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% ofBP as PF, 0.1% of BP for staff club fund. Generate pay slips for the employees with their gross and net salary.
3. Design a Java interface for ADT Stack. Implement this interface using array andbuilt-in classes. Provide necessary exception handling in both the implementations.
4. Write a Java Program to create an abstract class named Shape that contains two integers and an empty method named print Area(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains the methods print Area () that prints the areaof the given shape and Numberofsides() that prints the number of sides of the given shape.
5. Write a Java program to apply built-in and user defined exceptions.

## UNIT III MULTITHREADING, I/O AND GENERIC PROGRAMMING 9+9

Multithreaded Programming: Creating a Thread, Thread Priorities, Synchronization, Interthread Communication – I/O: I/O Basics, Reading Console Input, Writing Console Output, Reading and Writing Files – Generics: Introduction, Generic class, Bounded Types, Generic Methods, Generic Interfaces, Generic Restrictions.

**List of Exercise/Experiments:**

1.Write a Java program to read and copy the content of one file to other by handling all file related exceptions.

## UNIT IV STRING HANDLING AND COLLECTIONS 9+9

Lambda Expressions - String Handling – Collections: The Collection Interfaces, The Collection Classes – Iterator – Map - Regular Expression Processing.

**List of Exercise/Experiments:**

1. String Manipulation:
   a. Reversing a set of words and count the frequency of each letter in the string.
   b. Pattern Recognition - Find the number of patterns of form 1[0]1 where [0] represents any number of zeroes (minimum requirement is one 0) there should notbe any other character except 0 in the [0] sequence in a given binary string.
   c. Remove all the occurrences of string S2 in string S1 and print the remaining.
   d. Find the longest repeating sequence in a string
   e. Print the number of unique string values that can be formed by rearranging the letters in the string S.

2. Write a Java program that correctly implements producer consumer problem usingthe concept of inter thread communication.
3. Collections:
   a. Write a program to perform string operations using Array List. Write functions for the following
      i. Append - add at end
      ii. Insert – add at particular index
      iii. Search
      iv. List all string starts with given letter

   b. Find the frequency of words in a given text.

**UNIT V JDBC CONNECTIVITY 9+9**

JDBC – DataSource, Configurations, Connection, Connection Pools, Driver Types, ResultSet, Prepared Statement, Named Parameter, Embedded SQL (Insert, Update,Delete, Join, union etc), ResultSet Navigation, Connection Close and Clean up.

**List of Exercise/Experiments:**

Mini Project (using JDBC)

**TOTAL: 45+45=90 PERIODS**

**OUTCOMES:**

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

**CO1:** Solve core Java programming concepts.

**CO2:** Utilize object-oriented programming (OOP) principles.

**CO3:** Demonstrate competency in handling exceptions and implementing multithreading.

**CO4:** Develop expertise in input/output (I/O) operations and file handling.

**CO5:** Apply advanced Java programming concepts with generics and lambda expressions.

**CO6:** Implement database connectivity using JDBC.

**TEXTBOOKS:**

1. Herbert Schildt, “Java: The Complete Reference”, 11th Edition, McGraw Hill Education, 2019.

**REFERENCES:**

1. Cay S. Horstmann, Gary Cornell, “Core Java Volume – I Fundamentals”, 11thEdition, Prentice Hall, 2019.
2. Paul Deitel, Harvey Deitel, Java SE 8 for programmers, 3rd Edition, Pearson, 2015.
3. Steven Holzner, Java 2 Black book, Dream tech press, 2011.
4. Timothy Budd, Understanding Object-oriented programming with Java, ThirdEdition, Pearson Education, 2008.
5. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_29959473947367270000_shared/overview

**LIST OF EQUIPMENTS:**

Java and Eclipse / NetBeans IDE or Equivalent

| Course Code | PHYSICS FOR INFORMATION SCIENCE (Theory Course with Laboratory Component) | L | T | P | C |
|---|---|---|---|---|---|
| 24PH201 | | 3 | 0 | 2 | 4 |

**OBJECTIVES:**

**The course will enable the learners to:**

- understand the classical free electron theory and Fermi distribution function
- relate the theory of laser with its applications in optical fibers
- solve the Schrodinger's wave equation in one dimensional and three dimensional box
- gain the basic knowledge in quantum operators and quantum gates
- comprehend the behavior of semiconductor diodes in various electron devices and nano electronic devices

**UNIT I ELECTRICAL PROPERTIES OF MATERIALS 15**

Classical free electron theory - Expression for electrical conductivity and thermal conductivity - thermal conductivity of a bad conductor- Lee's disc method -Effect of temperature on Fermi function - Density of energy states and average energy of an electron at 0 K- Effective mass of electron - Concept of hole.

Semiconductors - Direct and Indirect bandgap semiconductors - Intrinsic Carrier Concentration - Bandgap Determination.

(Theory -9)

1. Determination of Thermal conductivity of a bad conductor - Lee's Disc Method
2. Bandgap determination of intrinsic semiconductor

(Laboratory- 6)

**UNIT II LASER 18**

Characteristics of Laser, Spatial and Temporal Coherence - Population inversion - Relation between Einstein's A and B coefficients - Components of Laser - Optical amplification (qualitative) - Semiconductor lasers: Homojunction and Heterojunction- Application: Engineering applications of lasers in data storage (qualitative), Principle of Fiber optics- Fiber optic communication system - Fiber optic sensors (pressure and displacement).

(Theory 9)

1. Determination of divergence of the laser beam
2. Determination of acceptance angle and numerical aperture of an optical fiber
3. Determination of wavelength of semiconductor laser

(Laboratory 9)

**UNIT III QUANTUM THEORY** **15**

Introduction- Blackbody Radiation - Newton's law of cooling - Planck's quantum theory- matter waves, de-Broglie wavelength, Heisenberg's Uncertainty principle, Time independent and Time-dependent Schrödinger's wave equations, Physical significance of wave function, Particle in a one-dimensional potential box - Particle in a three-dimensional box (qualitative) - degenerate and non-degenerate energy levels- Quantum tunneling - Scanning Tunneling Microscope (STM).

(Theory -9)

1. Determination of emissivity (Newton's law of cooling)
2. Determination of Planck's constant

(Laboratory- 6**)**

**UNIT IV BASICS OF QUANTUM COMPUTING** **12**

Quantum Operators: Linear vector spaces - inner product space - Hilbert space - examples Vectors and Tensors: Scalars and vectors, Dirac notations of Bra-Ket notation-Matrix representation of observables and states.

Quantum Computing: Quantum states - classical bits - quantum bits or qubits - Entanglement and superposition - multiple qubits - Bloch sphere - quantum gates - CNOT gate - Advantages of quantum computing over classical computing.

(Theory -9)

1. Truth table verification of CNOT gate through Virtual Laboratory

(Laboratory-3)

**UNIT V NANOELECTRONIC DEVICES** **15**

Introduction to Nano materials – synthesis by sol gel method, properties - Quantum confinement - Quantum structures: Density of energy states of quantum wells, quantum wires and quantum dots - band gap of nanomaterials - Quantum dot laser- Single electron phenomena -single electron transistor - Quantum system for information processing.

(Theory -12)

1. Synthesis of Nano-powders by sol-gel method

(Laboratory- 3)

**TOTAL: 75 PERIODS**

**COURSE OUTCOMES**

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

CO1: derive electrical and thermal conductivities using classical free electron theory

CO2: calculate the electrical conductivity and bandgap in Intrinsic semiconductors

CO3: associate the basic principles of working of laser and their applications in fiber optics

CO4: calculate the energy eigen value and eigen function for a particle in a one- dimensional and three dimensional box using Schrodinger wave equations

CO5: use quantum operators to frame equations for logic gates in Quantum computing

CO6: relate the quantum properties of nanoscale materials with their applications

**TEXTBOOKS:**


1. Neil W Ashcroft and N David Mermin, Solid State Physics, Harcourt College Publishers,1976
2. M.N. Avadhanulu and P.G. Kshirsagar, A textbook of Engineering Physics, S. Chand and Company, New Delhi, 2014.
3. David J. Griffiths, Introduction to Quantum Mechanics, 2nd Edition, Pearson Prentice-Hall (2004).
4. Thomas G. Wong, Introduction to Classical and Quantum Computing, Rooted Grove (2022).


**REFERENCES:**


1. R. A. Serway and J.W. Jewett, Physics for Scientists and Engineers, Ninth Edition, Cengage Learning, 2014.
2. Marikani, Materials Science, PHI Learning Private Limited, Eastern Economy Edition, 2017.
3. R. Wolfson, Essential University Physics, Volume 1 and 2 with Mastering Physics, Global Edition,3rd Edition, Pearson 2017.
4. B.K. Pandey and S. Chaturvedi, Engineering Physics, Cengage Learning India, 2012.
5. Scott Aaronson, Quantum Computing Since Democritus, Cambridge University Press (2014).
6. Mermin, N. David, Making better sense of quantum mechanics. Reports on Progress in Physics 82.1 (2018): 012002.
7. Michael Nielsen, L. Isaac Chuang, Quantum Computation and Quantum Information, Cambridge University Press (2010).
8. NPTEL course on “Introduction to LASER” by Prof. M. R. Shenoy, IIT Delhi : https://onlinecourses.nptel.ac.in/noc24_ph45/preview

9. NPTEL course on “Introduction to Quantum Computing: Quantum Algorithms and Qiskit” by Prof. Prabha Mandayam, Prof. Anupama Ray, Prof. Sheshashayee Raghunathan, IIT Madras, IBM Research, IBM Systems : https://onlinecourses.nptel.ac.in/noc24_cs67/preview
10. NPTEL course on “Introduction to Semiconductor Devices” by Prof. Naresh Kumar Emani, IIT Hyderabad : https://onlinecourses.nptel.ac.in/noc24_ee99/preview
11. Physics for Computer Science and Information Technology Laboratory Manual, R.M.D. Engineering College, 2022.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS**

| S. No. | Description of Equipment | Quantity |
|---|---|---|
| 1. | Semiconductor Laser | 6 Nos. |
| 2. | Determination of optical fiber parameters | 6 Nos. |
| 3. | Lee’s disc apparatus | 6 Nos. |
| 4. | Bandgap determination set-up | 6 Nos. |
| 5. | Sol-gel synthesis of nano-powders | 2 Nos. |
| 6. | Planck’s constant apparatus | 6 Nos. |
| 7. | Emissivity Determination | 6 Nos. |

| Course Code | INTRODUCTION TO ARTIFICIAL INTELLIGENCE (Theory Course with Laboratory Component) | L | T | P | C |
|---|---|---|---|---|---|
| 24AM201 | | 2 | 0 | 2 | 3 |

**OBJECTIVES:**

**The Course will enable learners to:**

- Understand the basics and applications of Artificial Intelligence.
- Apply the basics of Python programming.
- Use python libraries to solve simple problems.
- Understand the different types of Machine Learning algorithms.
- Solve real world problems using AI/ML.
- Explore the various applications in the field of Artificial Intelligence and Machine Learning.

**UNIT I ARTIFICIAL INTELLIGENCE 6+6**

Introduction – Types of AI – ANI, AGI, ASI – Narrow, General, Super AI, Examples - AI problems – Production Systems – State space Representation – Applications of AI in various industries.

**List of Exercise:**

1. Build a simple AI model using python.

**UNIT II BASICS OF PYTHON 6+6**

Introduction to Python programming – Arithmetic Operators - values and types - variables, expressions, statements – Functions – Conditionals and Recursion –Iteration.

Lists: Sequence, Mutable, Traversing, Operations, list slices, list methods - Tuples: Immutable, Tuple Assignment, Tuple as Return Values, Comparing and Sorting.

**List of Exercises:**

1. Compute the GCD of two numbers.
2. Operations on Tuples: a) finding repeated elements, b) slice a tuple c) reverse a tuple d) replace last value of a tuple.

**UNIT III PYTHON LIBRARIES 6+6**

Introduction to Numpy - Multidimensional Ndarrays – Indexing – Properties – Constants – Data Visualization: Ndarray Creation – Matplotlib - Introduction to Pandas – Series – Dataframes – Visualizing the Data in Dataframes - Pandas Objects – Data Indexing and Selection – Handling missing data – Hierarchical indexing – Combining datasets – Aggregation and Grouping – Joins- Pivot Tables - String operations – Working with time series – High performance Pandas.

**List of Exercises:**

1.Download, install and explore the features of R/Python for data analytics

- Installing Anaconda
- Basic Operations in Jupyter Notebook
- Basic Data Handling

2.Working with Numpy arrays - Creation of numpy array using the tuple, Determine the size, shape and dimension of the array, Manipulation with array Attributes, Creation of Sub array, Perform the reshaping of the array along the row vector and column vector, Create two arrays and perform the concatenation among the arrays.

3.Working with Pandas data frames - Series, DataFrame , and Index, Implement the Data Selection

Operations, Data indexing operations like: loc, iloc, and ix, operations of handling the missing data like None, Nan, Manipulate on the operation of Null Vaues (is null(), not null(), dropna(), fillna()).

4.Perform the Statistics operation for the data (the sum, product, median, minimum and maximum, quantiles, arg min, arg max etc.).

5.Use any data set compute the mean ,standard deviation, Percentile.

**UNIT IV MACHINE LEARNING** **6+6**

Introduction – ML Algorithms Overview – Types – Supervised – Unsupervised – Reinforcement Learning – Introduction to Neural Networks – Working of Deep Learning – Applications of DL – Ethical consideration in AI and ML.

**List of Exercise:**

1. Apply any Machine Learning model to predict the sales in a store.

**UNIT V CASE STUDIES** **6+6**

Disease Prediction – Share Price Forecasting – Weather Prediction – Domain Specific Case Studies.

List of Domain Specific Case Studies:

- For CSE & allied: Sentiment analysis of product reviews using machine learning.
- For ECE & allied: Smart homes using AI.
- For EEE: Forecasting of Renewable energy availability during a specified period using AI.
- Civil: Application of ML for crack detection on concrete structures.
- Mech: Predictive Maintenance for CNC Machines Using AI and Machine Learning.

**List of Exercise:**

1. Build a machine learning model to solve any real-world problem from your domain.

**TOTAL: 30(L) + 30(P) = 60 PERIODS**

**OUTCOMES:**

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

**CO1:** Elaborate the basics and applications of Artificial Intelligence**.**

**CO2:** Apply the basics of Python programming to solve problems.

**CO3:** Use python libraries to solve simple ML problems.

**CO4:** Outline the different types of Machine Learning algorithms.

**CO5:** Use Machine Learning Algorithms to solve real world problems.

**CO6:** Outline the recent developments in the field of Artificial Intelligence.

**TEXT BOOKS:**

1. Allen B. Downey, “Think Python: How to Think Like a Computer Scientist”, 2nd edition, Updated for Python 3, Shroff/O‘Reilly Publishers, 2016.

2. Jake VanderPlas, “Python Data Science Handbook – Essential tools for working with data”, O’Reilly, 2017.

3. Steve Abrams, “Artificial Intelligence and Machine Learning for Beginners: A simple guide to understanding and Applying AI and ML”, Independently published, May 14, 2024.

**REFERENCES:**


1. Vinod Chandra S S, Anand Hareendran S, Artificial Intelligence and Machine Learning, PHI Learning, 2014.
2. Russell, S. and Norvig, P, Artificial Intelligence: A Modern Approach, Third Edition, Prentice Hall, 2010.
3. Ethem Alpaydın, Introduction to Machine Learning, Second Edition, the MIT Press, Cambridge, Massachusetts, London, England.
4. Stephen Marsland, Machine Learning - An Algorithmic Perspective, 2nd Edition, 2015, by Taylor & Francis Group, 2015.
5. Tom M. Mitchell, Machine Learning, McGraw-Hill Science, ISBN: 0070428077
6. Mayuri Mehta, Vasile Palade, Indranath Chatterjee, Explainable AI: Foundations, Methodologies and Applications, Springer, 2023.
7. Siddhartha Bhattacharyya, Indrajit Pan, Ashish Mani, Sourav De, Elizabeth Behrman, Susanta Chakraborti, "Quantum Machine Learning", De Gruyter Frontiers in Computational Intelligence, 2020.


**LIST OF EQUIPMENTS:**

1. Systems with Anaconda, Jupyter Notebook, Python.

| Course Code | IDEA LAB – II | L | T | P | C |
|---|---|---|---|---|---|
| 24GE211 | | 0 | 0 | 2 | 1 |

**OBJECTIVES:**

**Students completing this course are expected to**

- Develop hands-on experience and practical application of theoretical knowledge.
- Develop their ability to explain the process involved.

**LIST OF EXERCISES:**

1. Printing of a 3D part.
2. Scanning of a 3D part.
3. Design and fabrication of press fit object using laser cutting machine.
4. Design and fabrication of 3D part using CNC Router.
5. Design and fabrication of simple PCB.
6. Soldering and desoldering of given electronic circuit.

**TOTAL: 30 PERIODS**

**OUTCOMES:**

**After successful completion of the course, the students will be able to**

CO1 Analyze the latest manufacturing methods in advancements and technologies related to their field.

CO2 Understand the operations of a laser cutting machine and CNC Router.

CO3 Analyze the process of design and fabrication of PCB and Soldering operations

CO4 Develop technical proficiency and problem-solving abilities, making more competent and confident in their field.

CO5 Develop themselves with the skills needed to address industry-specific problems.

## LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

| S.No | Equipment Name | Quantity |
|---|---|---|
| 1 | CNC Router | 1 No |
| 2 | 3D Printer | 1 No |
| 3 | 3D Scanner | 1 No |
| 4 | Laser cutting Machine | 1 No |
| 5 | Multimeter | 5 Nos |
| 6 | Solder Stations | 5 Sets |
| 7 | Desoldering Machine | 1 No |
| 8 | PCB Milling Machine | 1 No |
| 9 | Variable Power Supply | 1 No |
| 10 | Electronic Components like Resistors, Transistors, Diode, Inductor, Capacitor, etc. | 5 Sets |

| Course Code | INNOVATION AND CREATIVITY SKILLS DEVELOPMENT | L | T | P | C |
|---|---|---|---|---|---|
| 24HS211 | | 1 | 0 | 0 | 1 |

**OBJECTIVES:**

**The course will enable the learners to:**

- Understand study plans, co-curricular activities, programming skills, recruitment test patterns, and hiring strategies through national qualifiers and hackathons.
- Equip students with strategies for higher education, resume enhancement, project management, and securing internships
- Understand entrepreneurship fundamentals, including key differences, global hubs, business ideas, and scalability.
- Develop essential entrepreneurial skills such as opportunity recognition, patience, risk management, communication, persistence, and leadership
- Understand life, success, self-confidence, health, scientific heritage, personal counseling, and cybercrime awareness

**UNIT I STEPPING STONE – ENGINEERING CAREERS AND SKILL DEVELOPMENT 3**

Study Plans and Resources - Identification of key resources and job opportunities - career prospects and academic growth through co-curricular activities - importance of programming/coding skills - Overview of test patterns and essential skills for popular campus recruiters - Comparison of IT Services, Dream, and Super Dream offers and their recruitment processes - National Qualifier Tests and their impact on hiring processes – Overview of Corporate contests and hackathons (e.g., TCS Codevita, HackerRank)

**UNIT II STEPPING STONE – HIGHER EDUCATION AND CAREER DEVELOPMENT 3**

Overview of higher education opportunities: GATE, GRE, GMAT, XAT, CAT, MAT - Exam formats, preparation strategies, and timelines - Resume Enhancement Strategies - Project Management - Steps to develop projects from proposal to prototype - Internship Pathways - Strategies for maximizing internship experiences for career advancement

**UNIT III FUNDAMENTALS OF ENTREPRENEURSHIP: FROM IDEAS TO VENTURES 3**

Introduction to Entrepreneurship – Intrapreneur vs. entrepreneur - Roles and Contributions - Global Entrepreneurship Hubs - Overview of Key Global Locations - Idea vs. Commercial Value - Transforming Ideas into Viable Business Models - Characteristics of Successful Business Ideas - Understanding Market Competition - Basics of Copyrights and Intellectual Property - Scalability in Business Ventures - Strategies for Scaling a Business

**UNIT IV HUMAN SKILLS FOR ENTREPRENEURSHIP 3**

Identifying and capitalizing on business opportunities - Case studies and anecdotes - Patience and Risk Management - The role of patience in entrepreneurial success and decision-making - Effective Communication - Techniques for clear and persuasive communication - Importance of communication in building and leading teams - Leadership qualities and their impact on entrepreneurial ventures - Analyzing success and failure stories

## UNIT V FOUNDATIONS OF PERSONAL DEVELOPMENT AND WELL-BEING 3

Understanding Life and Success - Self-Confidence and Fear - Practical strategies for enhancing self-esteem - Adolescent Issues - Health Management - Basics of a balanced diet - Benefits of physical activity - Scientific Heritage of India - Overview of India's scientific achievements and contributions - Cyber Crime Awareness - Types and prevention strategies.

**TOTAL: 15 PERIODS**

## COURSE OUTCOMES

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

CO1: Create study plans, value co-curricular activities, develop programming skills, and navigate for career advancement

CO2: Understand about higher education options, resume enhancement, project management, and securing internships

CO3: Learn entrepreneurship skills and strategies to develop successful business ideas.

CO4: Develop key entrepreneurial skills like opportunity recognition, risk management, and leadership through real-world examples

CO5: Explore personal development, health management, scientific heritage, and cybercrime awareness.

| Course Code | ENVIRONMENTAL SCIENCE AND SUSTAINABILITY | L | T | P | C |
|---|---|---|---|---|---|
| 24MC102 | | 2 | 0 | 0 | 0 |

**OBJECTIVES:**

**The course will enable the learners**

- To gain knowledge of the environment and various natural resources.
- To identify the Scientific and Technological solutions to pollution issues and waste management.
- To understand the significance of the conservation of biodiversity.
- To recognize the needs and benefits of sustainability and its management.
- To comprehend the effects of human population on the environment.

**UNIT I NATURAL RESOURCES 7**

Definition, scope and importance of environment – need for public awareness. Introduction to natural resources - types - forest resources: use and over-exploitation, deforestation and its impacts, food resources: effects of modern agriculture, organic farming, renewable energy sources - solar, wind, geothermal, tidal, OTE and biomass. field activity -tree plantation

**UNIT II POLLUTION AND WASTE MANAGEMENT 7**

Pollution - definition –causes, effects and control measures of (a) air pollution (b) water pollution (c) soil pollution (d) noise pollution (e) nuclear hazards - nuclear accidents and holocaust - role of an individual in prevention of pollution –case studies.

Waste management- municipal solid wastes, E- waste, plastic waste.Field

study – Solid waste management of the institution

**UNIT III BIODIVERSITY AND ITS CONSERVATION 6**

Biodiversity: types – values of biodiversity, India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity – endangered and endemic species, extinct, rare, vulnerable species of India – conservation of biodiversity: in-situ and ex-situ method.

Field study – Biodiversity of the institution

**UNIT IV SUSTAINABILITY AND MANAGEMENT 5**

Sustainability-concept, needs and challenges- circular economy - sustainable development goals-concept of carbon footprint, environmental impact assessment, clean development mechanism, solutions.

Field study – Alternate energy sources and its impacts

**UNIT - V HUMAN POPULATION** **5**

Introduction - population growth, variation among nations, population explosion, environment and human health – endemic/epidemic/pandemic – role of information technology in environment and human health.

Case Study – Pandemics of 21st century

**TOTAL: 30 PERIODS**

**COURSE OUTCOMES:**

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

CO1: To investigate and use conservational practices to protect natural resources.

CO2: To identify the causes of pollutants and illustrate suitable methods for pollution abatement.

CO3: To analyze the values of biodiversity and its conservational methods.

CO4: To classify suitable sustainable development practices and apply it in day-to-day life.

CO5: To assess the impacts of human population and suggest suitable solutions.

CO6: To develop innovative solutions and strategies to address sustainability challenges.

**TEXTBOOKS:**


1. Anubha Kaushik and C.P. Kaushik, "Perspectives in environmental studies", New Age International Publishers, 8th edition, 2024.
2. Benny Joseph, Environmental Science and Engineering, McGraw-Hill, 1st edition, 2017.
3. Gilbert M. Masters, Introduction to Environmental Engineering and Science, Pearson Education, 3rd edition, 2014.
4. Erach Bharuch, Textbook of Environmental Studies for Undergraduate Courses, Universities Press(I) Pvt. Ltd., 3rd edition, 2021.


**REFERENCES:**


1. William P. Cunningham and Mary Ann Cunningham Environmental Science: A Global Concern, McGraw Hill, 14th edition, 2017.
2. Rajagopalan, R, Environmental Studies-From Crisis to Cure, Oxford University Press, 2015.
3. G. Tyler Miller and Scott E. Spoolman, ―Environmental Science, Cengage Learning India Pvt, Ltd., Delhi, 2014.
4. Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall, 2012.
5. Bradley. A.S; Adebayo, A.O. and Maria, P. Engineering applications in sustainable design and development, Cengage learning, 2015.
6. Environment Impact Assessment Guidelines, Notification of Government of India, 2006 and subsequent amendments, 2022.

| Course Code | YOGA FOR STRESS MANAGEMENT | L | T | P | C |
|---|---|---|---|---|---|
| 24AC201 | | 0 | 0 | 1 | 0 |

**OBJECTIVES:**

**The course will enable the learners to:**

- Understanding the different types of stress and managing stress.
- Develop an understanding of practicing yoga
- Learning to do asanas, including sitting, standing and lying postures

**Unit I: Stress Management** **3**

Definition of Stress - Stress in Daily Life - Impact of Stress on Life - Identifying the Causes of Stress - Symptoms of Stress - Managing Stress (Habits, Tools, Training, Professional Help) - Complications of Stress Mismanagement - The Importance of Sleep for Mental Wellness - Connection Between Sleep and Digestion.

**Unit II: Introduction to Yoga** **3**

Meaning and Definition of Yoga - Aims and Objectives of Yoga - Guidelines for Practicing Asanas - Benefits of Yoga

**Unit III: Different Asanas** **3**

Methods of Performing Asanas - Pranayama - Suryanamaskar Asanas - Sitting Postures: Uttanpadasana, Paschimottanasana ,Janu Sirsasana , Baddha Konasana - Shishupal Asana - Vajrasana

**Unit IV: Standing Postures** **3**

Uttanasana -Trikonasana -Vrikshasana -Tadasana - Superbrain asana

**Unit 5: Lying Postures** **3**

Pavana Muktasana - Pada Sanchalanasana – Jhulana Lurhakanasana -Dhanurasana – Marjaryasana. BitilasanaDictionaries – Sorkuvai Project.

**TOTAL: 15 PERIODS**

**COURSE OUTCOMES:**

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

CO1: relieve stress and achieve mental wellness.

CO2: experience the benefits of yoga

CO3: keep self and body healthy

**REFERENCE BOOK:**

1. Iyengar, Bellur Krishnamukar Sundara. "Light on yoga." (1965).

2. Desikachar, Tirumalai Krishnamacharya Venkata. The heart of yoga: Developing a personal practice. Simon and Schuster, 1999.

3. Davis, Martha, Elizabeth Robbins Eshelman, and Matthew McKay. The relaxation and stress reduction workbook. New Harbinger Publications, 2008.

4. Krishnamacharya, Tirumalai, et al. "Yoga makaranda: The nectar of yoga." Swathi Soft (2013).

# SEMESTER III

| 24CS301 | COMPUTER ORGANIZATION AND ARCHITECTURE (Common to CSE, IT and AIML) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

**The Course will enable learners to:**

- Describe the basic principles and operations of digital computers.
- Design arithmetic and logic unit for various fixed and floating point operations
- Construct pipeline architectures for RISC processors.
- Explain various memory systems & I/O interfacings
- Discuss parallel processor and multi-processor architectures

| UNIT I | COMPUTER FUNDAMENTALS | 9 |
|---|---|---|

Computer Types - Functional Units — Basic Operational Concepts - Number Representation and Arithmetic Operations - Performance Measurement - Instruction Set Architecture - Memory Locations and Addresses - Instructions and Instruction Sequencing - Addressing Modes.

| UNIT II | COMPUTER ARITHMETIC | 9 |
|---|---|---|

Addition and Subtraction of Signed Numbers - Design of Fast Adders - Multiplication of Unsigned Numbers - Multiplication of Signed Numbers - Fast Multiplication - Integer Division - Floating-Point Numbers – Representation and Operations.

**Study Experiments: Ripple Carry Adder, Carry Look-a-head Adder, Booth's Multiplier**

| UNIT III | BASIC PROCESSING UNIT AND PIPELINING | 9 |
|---|---|---|

Basic Processing Unit: Concepts - Instruction Execution - Hardware Components - Instruction Fetch and Execution Steps -Control Signals - Hardwired Control.

Pipelining: Basic Concept - Pipeline Organization- Pipelining Issues - Data Dependencies - Memory Delays - Branch Delays - Resource Limitations - Performance Evaluation - Superscalar Operation.

**Study Experiments: Arithmetic Logic Unit, CPU Design**

| UNIT IV | I/O AND MEMORY | 9 |
|---|---|---|

Input/Output Organization: Bus Structure - Bus Operation - Arbitration - The Memory System: Basic Concepts - Semiconductor RAM Memories - Read-only Memories - Direct Memory Access - Memory Hierarchy - Cache Memories - Performance Considerations - Virtual Memory - Memory Management Requirements - Secondary Storage.

**Study Experiments: Memory Design, Associative Cache Design, Direct Mapped Cache Design.**

| UNIT V | PARALLEL PROCESSING AND MULTICORE COMPUTERS | 9 |
|---|---|---|

Parallel Processing: Use of Multiple Processors - Symmetric Multiprocessors - Multithreading and Chip Multiprocessors - Clusters - Nonuniform Memory Access Computers - Vector Computation - Multicore Organization.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

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

**CO1:** Infer the basic principles and operations of digital computers.
**CO2:** Analyze the performance of computers by identifying factors that contribute to performance.
**CO3:** Apply arithmetic algorithms for various operations.
**CO4:** Design hardware to solve computationally intensive problems.
**CO5:** Compare various I/O methods and analyze memory management techniques.

**CO6:** Demonstrate the concept of parallelism in hardware and software

**TEXT BOOKS:**

1.Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Computer organization, Tata McGraw Hill, Sixth edition, 2012.

2.David A. Patterson and John L. Hennessy Computer Organization and Design-The Hardware/Software Interface, 5th edition, Morgan Kaufmann, 2013.

**REFERENCES:**

1.John P.Hayes, Computer Architecture and Organization, Third Edition, Tata McGraw Hill, 2012.

2.David A. Patterson and John L. Hennessy Computer Organization and Design-The Hardware/Software Interface, 6th edition, Morgan Kaufmann, 2021.

3.John L. Hennessy and David A. Patterson, Computer Architecture – A Quantitate Approach, Morgan Kaufmann / Elsevier Publishers, Fifth Edition,2012.

| 24CS302 | ADVANCED JAVA PROGRAMMING<br>(Lab Integrated)<br>(Common to All Branches) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 3 | 4.5 |

**OBJECTIVES:**

**The Course will enable learners to:**

- Gain a comprehensive understanding of the Java Collections Framework and its various interfaces and implementations.
- Learn the details of Java I/O streams and utility classes for managing dates, numbers, and currencies.
- Develop a thorough understanding of the Stream API introduced in Java 8 and its various operations.
- Explore advanced object serialization and string tokenizing techniques, including pattern matching with regular expressions.
- Understand advanced Stream API features and gain proficiency in using regular expressions for text processing.

| UNIT I | COLLECTIONS FRAMEWORK AND UTILITY CLASSES | 9+9 |
|---|---|---|

Introduction to Collections Framework - Collection Interface- Methods in Collection Interface - Iterable and Iterator Interfaces - List Interface- ArrayList - LinkedList - Set Interface - HashSet- LinkedHashSet - TreeSet - Map Interface - HashMap -LinkedHashMap- TreeMap - Queue Interface -PriorityQueue - Deque Interface - Utility Classes.

**List of Experiments**

1. Write a program that measures the time taken for insertion, deletion, and search operations on ArrayList, LinkedList, HashSet, and TreeSet for varying sizes of input data.
2. Implement a custom data structure that combines features of a list and a set.
3. Write a Java program to create a HashMap where the keys are strings, and the values are integers Add five key-value pairs to the map. Print all the keys and values in the map. Remove an entry by key. Update the value associated with a specific key. Check if the map contains a specific key and a specific value.

| UNIT II | DATE HANDLING AND SERIALIZATION | 9+9 |
|---|---|---|

Date – Calendar – Comparable interface – Observer Interface –– Serialization – Dates - Numbers, and Currency - Working with Dates - Numbers and Currencies - Object Serialization - Serializable Interface - Writing and Reading Serializable Objects -Transient Keyword- SerialVersionUID.

**List of Experiments**

1. Create a class representing a complex object with nested data structures. Serialize the object to a file, then deserialize it back and verify that the object remains intact.
2. Write a program that formats dates and currencies according to different locales.
3. Create a class hierarchy representing different types of objects (e.g., Person, Employee). Serialize instances of these classes to a file using object serialization.

| UNIT III | STREAM API AND FUNCTIONAL PROGRAMMING PARADIGMS | 9+9 |
|---|---|---|

Overview of Stream API - Importance of Stream API in Java 8 and Beyond – Functional Programming Concepts - Creating Streams - Stream Interface Methods - Stream Operations -

Intermediate Filtering (filter)-Mapping (map, flatMap)-Sorting (sorted)-Distinct (distinct) - Limit and Skip (limit, skip) - Terminal Operations -Collecting Results (collect) - Reducing and Summarizing (reduce, summaryStatistics)-Iterating (forEach) - Matching and Finding (anyMatch, allMatch, noneMatch, findFirst, findAny) -Counting (count).

**List of Experiments**

1. Write a program that performs stream operations like filtering, mapping, and reducing.
2. Create an infinite stream generator that generates prime numbers. Implement methods to check for primality and generate the next prime number.
3. Write a program that reads a text file containing sentences. Tokenize each sentence into words, filter out stopwords, and print the remaining words.

| UNIT IV | ADVANCED STRING PROCESSING AND I/O TECHNIQUES | 9+9 |
|---|---|---|

String Tokenizer – Parsing - Tokenizing and Formatting - Locating Data via Pattern Matching, Tokenizing - Streams - Types of Streams - The Byte-stream I/O hierarchy - Character Stream Hierarchy – Random Access File class – the java.io. Console Class - Advanced I/O - Piped Streams (PipedInputStream and PipedOutputStream) – SequenceInputStream -PushbackInputStream and PushbackReader.

**List of Experiments**

1. Write a program that reads a text file and tokenizes it into sentences using the StringTokenizer class.
2. Implement a java program that allows users to open a text file, navigate through it using random access, insert, delete, and modify text at specific positions within the file.
3. Implement a program that uses advanced I/O techniques like PipedInputStream, PipedOutputStream, SequenceInputStream, and PushbackInputStream.

| UNIT V | ADVANCED STREAM FEATURES AND REGULAR EXPRESSIONS | 9+9 |
|---|---|---|

Importance and Use Cases of Advanced Stream Features - Creating Custom Streams -Stream Generators (Stream.generate, Stream.iterate) - Infinite Streams - Using Spliterators – Advanced Stream Operations - FlatMapping - Chaining Stream Operations - Stream Peeking (peek) - Advanced Filtering Techniques - Introduction to Regular Expressions - Character Classes - Quantifiers - Pattern Matching - Groups and Capturing - Regex in Java - java.util.regex Package Pattern Class - Matcher Class - String Manipulation with Regex - Splitting Strings - Replacing Text (replaceAll, replaceFirst) - Replacing with Backreferences.

**List of Experiments**

1. Implement custom stream generators using Stream.generate and Stream.iterate methods.
2. Write a program that demonstrates advanced stream operations like flatMapping, chaining stream operations, and peeking.
3. Develop a program that utilizes regular expressions to perform string manipulation tasks such as splitting strings, replacing text, and extracting specific patterns.

**TOTAL: 45+45 = 90 PERIODS**

**OUTCOMES:**

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

**CO1**: Implement various data structures by utilizing core Java features and libraries

**CO2:** Demonstrate proficiency in handling Java I/O operations, including file manipulation for efficient data storage and retrieval.

**CO3:** Apply and Analyze the Stream API for functional programming and data processing.

**CO4:** Implement advanced object serialization for complex data structures.

**CO5:** Utilize regular expressions for text parsing and string manipulation.

**CO6:** Build applications using advanced Java programming techniques.

**TEXT BOOK:**


1. Cay S. Horstmann, "Core Java Volume I--Fundamentals," 12th Edition, 2019.
2. Joshua Bloch, "Effective Java," 3rd Edition, 2018.
3. Raoul-Gabriel Urma, "Java 8 in Action: Lambdas, Streams, and Functional-Style Programming," 1st Edition, 2014.
4. Herbert Schildt, "Java: The Complete Reference," 11th Edition, 2018.
5. Alan Mycroft and Martin Odersky, "Programming in Scala," 4th Edition, 2020.


**REFERENCES:**


1. Bruce Eckel, "Thinking in Java," 4th Edition, 2006.
2. Herbert Schildt, "Java: A Beginner's Guide," 8th Edition, 2019.
3. Richard Warburton, "Java 8 Lambdas: Pragmatic Functional Programming," 1st Edition, 2014.


LIST OF EQUIPMENTS:

JDK/Eclipse

| 24CS303 | DATABASE MANAGEMENT SYSTEMS (Lab Integrated) (Common to all Branches) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 3 | 4.5 |

**COURSE OBJECTIVES:**

**The Course will enable the learners:**

- To understand the basic concepts of Data Modeling and Database Systems.
- To understand SQL and effective relational database design concepts.
- To learn relational algebra, calculus and normalization.
- To know the fundamental concepts of transaction processing, concurrency control techniques, recovery procedure and data storage techniques.
- To understand query processing, efficient data querying and advanced databases.

| UNIT I | DATABASE CONCEPTS | 9+9 |
|---|---|---|

Concept of Database and Overview of DBMS - Characteristics of databases -Data Models, Schemas and Instances - Three-Schema Architecture - Database Languages and Interfaces- Introductions to data models types- ER Model- ER Diagrams - Enhanced ER Model - reducing ER to table Applications: ER model of University Database Application – Relational Database Design by ER- and EER-to-Relational Mapping.

**List of Exercise/Experiments**

Case Study using real life database applications anyone from the following list

a) Inventory Management for a EMart Grocery Shop

b) Society Financial Management

c) Cop Friendly App – Eseva

d) Property Management – eMall

e) Star Small and Medium Banking and Finance

- Build Entity Model diagram. The diagram should align with the business and functional goals stated in the application.

| UNIT II | STRUCTURED QUERY LANGUAGE | 9+9 |
|---|---|---|

SQL Data Definition and Data Types – Constraints – Queries – INSERT, UPDATE, and DELETE in SQL - Views - Integrity Procedures, Functions, Cursor and Triggers - Embedded SQL - Dynamic SQL.

**List of Exercise/Experiments**

Case Study using real life database applications anyone from the following list and do the following exercises.

a) Inventory Management for a EMart Grocery Shop

b) Society Financial Management

c) Cop Friendly App – Eseva
d) Property Management – eMall
e) Star Small and Medium Banking and Finance

1. Data Definition Commands, Data Manipulation Commands for inserting, deleting, updating and retrieving Tables and Transaction Control statements
2. Database Querying – Simple queries, Nested queries, Sub queries and Joins
3. Views, Sequences, Synonyms
4. Database Programming: Implicit and Explicit Cursors
5. Procedures and Functions
6. Triggers
7. Exception Handling

| UNIT III | RELATIONAL ALGEBRA, CALCULUS AND NORMALIZATION | 9+9 |
|---|---|---|

Relational Algebra – Operations - Domain Relational Calculus- Tuple Relational Calculus - Fundamental operations.

Relational Database Design - Functional Dependency – Normalization (1NF, 2NF 3NF and BCNF) –Multivalued Dependency and 4NF –Joint Dependencies and 5NF - De-normalization.

**List of Exercise/Experiments**

1. Case Study using real life database applications anyone from the following list
   a) Inventory Management for a EMart Grocery Shop
   b) Society Financial Management
   c) Cop Friendly App – Eseva
   d) Property Management – eMall
   e) Star Small and Medium Banking and Finance.

Apply Normalization rules in designing the tables in scope.

| UNIT IV | TRANSACTIONS, CONCURRENCY CONTROL AND DATA STORAGE | 9+9 |
|---|---|---|

Transaction Concepts – ACID Properties – Schedules based on Recoverability, Serializability – Concurrency Control – Need for Concurrency – Locking Protocols – Two Phase Locking – Transaction Recovery –Concepts – Deferred Update – Immediate Update.

Organization of Records in Files – Unordered, Ordered – Hashing Techniques – RAID – Ordered Indexes – Multilevel Indexes - B+ tree Index Files – B tree Index Files.

**List of Exercise/Experiments**

Case Study using real life database applications anyone from the following list
a) Inventory Management for a EMart Grocery Shop
b) Society Financial Management
c) Cop Friendly App – Eseva
d) Property Management – eMall
e) Star Small and Medium Banking and Finance

Ability to showcase ACID Properties with sample queries with appropriate settings for the above

scenario.

| UNIT V | QUERY OPTIMIZATION AND ADVANCED DATABASES | 9+9 |
|---|---|---|

Query Processing Overview – Algorithms for SELECT and JOIN operations – Query optimization using Heuristics.
Distributed Database Concepts – Design –Concurrency Control and Recovery – NOSQL Systems – Document-Based NOSQL Systems and MongoDB.
Explain Plan Statement – Parsing Output – Join Orders and Methods – Indexes - Standard Issues – Query Tuning - Explain Plan vs Explain Analyses.

**List of Exercise/Experiments**

Case Study using real life database applications anyone from the following list

a) Inventory Management for a EMart Grocery Shop
b) Society Financial Management
c) Cop Friendly App – Eseva
d) Property Management – eMall
e) Star Small and Medium Banking and Finance

Build PL SQL / Stored Procedures for Complex Functionalities, ex EOD Batch Processing for calculating the EMI for Gold Loan for each eligible Customer.

**TOTAL: 45 + 45 = 90 PERIODS**

**OUTCOMES:**

After completing the course, students will have the ability to

CO1: Map ER model to Relational model to perform database design effectively.
CO2: Implement SQL and effective relational database design concepts.
CO3:Apply relational algebra, calculus and normalization techniques in database design.
CO4: Understand the concepts of transaction processing, concurrency control, recovery procedure and data storage techniques.
CO5:Evaluate and implement transaction processing, concurrency control mechanisms, and recovery procedures to maintain data integrity.
CO6:Analyze and optimize database queries and understand the features and applications of advanced and distributed database systems, including NoSQL.

**TEXTBOOKS:**


1. Elmasri R. and S. Navathe, “Fundamentals of Database Systems”, Pearson Education, 7th Edition, 2016.
2. Abraham Silberschatz, Henry F.Korth, “Database System Concepts”, Tata McGraw Hill , 7th Edition, 2021.


**REFERENCES:**


1. Elmasri R. and S. Navathe, Database Systems: Models, Languages, Design and Application Programming, Pearson Education, 2013.Raghu Ramakrishnan, Gehrke “Database

Management Systems", MCGraw Hill, 3rd Edition 2014.

2. Plunkett T., B. Macdonald, "Oracle Big Data Hand Book" , McGraw Hill, First Edition, 2013
3. Gupta G K , "Database Management Systems" , Tata McGraw Hill Education Private Limited, New Delhi, 2011
4. C. J. Date, A. Kannan, S. Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2015.
5. Maqsood Alam, Aalok Muley, Chaitanya Kadaru, Ashok Joshi, Oracle NoSQL Database: Real-Time Big Data Management for the Enterprise, McGraw Hill Professional, 2013.
6. Thomas Connolly, Carolyn Begg, "Database Systems: A Practical Approach to Design, Implementation and Management", Pearson, 6th Edition, 2015.
7. Database Management System Part – 1
   https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012758066728202245 6_shared/overview
8. Database Management System Part – 2
   https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012767300562919424 1_shared/overview
9. Online Resources:
10. https://infyspringboard.onwingspan.com/web/en/page/home

| 24CS304 | OPERATING SYSTEMS<br>(Common to CSE, IT and AIML ) | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**OBJECTIVES:**

**The Course will enable learners to:**

- Explain the basic concepts of operating systems and process.
- Discuss threads and analyse various CPU scheduling algorithms.
- Describe the concept of process synchronization and deadlocks.
- Analyse various memory management schemes.
- Describe I/O management and file systems.

| UNIT I | INTRODUCTION TO OPERATING SYSTEMS AND PROCESSES | 6+6 |
|---|---|---|

Introduction: Computer system organization - architecture – Resource management - Protection and Security – Virtualization - Operating System Structures: Services - User and Operating-System Interface - System Calls - System Services - Design and Implementation - Building and Booting an Operating System – Processes: Process Concept - Process Scheduling - Operations on Processes – Inter process Communication - IPC in Shared-Memory Systems - IPC in Message-Passing Systems

**List of Exercise/Experiments:**

1. Basic Unix file system commands such as ls, cd, mkdir, rmdir, cp, rm, mv, more, lpr, man, grep, sed, etc..
2. Programs using Shell Programming.
3. Implementation of Unix System Calls.
4. Implementation of IPC using message queue
   a. Get the input data (integer value) from a process called sender
   b. Use Message Queue to transfer this data from sender to receiver process
   c. The receiver does the prime number checking on the received data
   d. Communicate the verified/status result from receiver to sender process, this status should be displayed in the Sender process.

Note: Simultaneously execute two or more processes. Don't do it as a single process

| UNIT II | THREADS AND CPU SCHEDULING | 6+6 |
|---|---|---|

Threads & Concurrency: Overview - Multicore Programming - Multithreading Models - Thread Libraries - Implicit Threading - Threading Issues - CPU Scheduling: Basic Concepts – Scheduling Criteria - Scheduling Algorithms - Thread Scheduling - Multi-Processor Scheduling - Real-Time CPU Scheduling

**List of Exercise/Experiments:**

1. Write a program to implement the following actions using pthreads
   a. Create a thread in a program and called Parent thread, this parent thread creates another thread (Child thread) to print out the numbers from 1 to 20. The Parent thread waits till the child thread finishes
   b. Create a thread in the main program, this program passes the 'count' as arguments to that thread function and this created thread function has to print your name 'count' times.
2. Write C programs to implement the various CPU Scheduling Algorithms.

| UNIT III | PROCESS SYNCHRONISATION AND DEADLOCKS | 6+6 |
|---|---|---|

Process Synchronization: The critical-section problem – Peterson's Solution, Synchronization hardware, Mutex locks, Semaphores, monitors - Classic problems of synchronization: Bounded Buffer Problem - Reader's & Writer Problem, Dinning Philosopher Problem. Deadlock: System model - Deadlock characterization, Methods for handling

deadlocks - Deadlock prevention - Deadlock avoidance - Deadlock detection - Recovery from deadlock.

**List of Exercise/Experiments:**

1. Process Synchronization using Semaphores. A shared data has to be accessed by two categories of processes namely A and B. Satisfy the following constraints to access the data without any data loss.
   a. When a process A1 is accessing the database another process of the same category is permitted.
   b. When a process B1 is accessing the database neither process A1 nor another 74 process B2 is permitted.
   c. When a process A1 is accessing the database process B1 should not be allowed to access the database. Write appropriate code for both A and B satisfying all the above constraints using semaphores.

   Note: The time-stamp for accessing is approximately 10 sec.
2. Bankers Algorithm for Deadlock Avoidance

| UNIT IV | MEMORY MANAGEMENT | 6+6 |
|---|---|---|

Memory Management: Contiguous Memory Allocation - Paging - Structure of the Page Table – Swapping - Virtual Memory: Demand Paging – Copy-on write – Page Replacement – Allocation of frames – Thrashing – Memory Compression

**List of Exercise/Experiments:**

1. Analysis and Simulation of Memory Allocation and Management Techniques
   i. First Fit ii. Best Fit iii. Worst Fit
2. Implementation of Page Replacement Techniques
   i. FIFO ii. LRU iii. Optimal page replacement

| UNIT V | STORAGE MANAGEMENT | 6+6 |
|---|---|---|

Mass Storage Structure: Overview of Mass Storage Structure- HDD scheduling – Swap Space Management, I/O systems: I/O Hardware, Application I/O interface, Kernel I/O Subsystem, File System Interface: File Concept – Access Methods – Directory Structure – Protection, File-System Implementation: File-System Structure- File-System Operations - Directory Implementation - Allocation Methods - Free-Space Management, - Case Study-Linux

**List of Exercise/Experiments:**

1. Simulation of File Allocation Techniques
   i. Sequential ii. Linked list iii. indexed
2. Implementation of File Organization Strategies
   Single level directory ii. Two level directory iii. Hierarchical level directory

**TOTAL: 60 PERIODS**

**OUTCOMES:**

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

**CO1:** Demonstrate the basic concepts of operating systems and process.

**CO2:** Implement process management techniques using inter-process communication.

**CO3:** Implement the concepts of process synchronization and deadlocks.

**CO4:** Apply various memory management schemes for the suitable scenario.

**CO5:** Describe various I/O and file management techniques.

**CO6:** Develop practical skills in developing system-level programming.

**TEXTBOOKS:**

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, “Operating System Concepts” II, 10th Edition, John Wiley and Sons Inc., 2018.
2. Andrew S Tanenbaum, "Modern Operating Systems", Pearson, 5th Edition, 2022 New Delhi.

**REFERENCES:**

1. William Stallings, "Operating Systems: Internals and Design Principles", 7th Edition, Prentice Hall, 2018.
2. Achyut S.Godbole, Atul Kahate, “Operating Systems”, McGraw Hill Education, 2016.

**LIST OF EQUIPMENTS:**

1. Standalone desktops with C/C++/Java/Equivalent compiler

| Course Code | UNIVERSAL HUMAN VALUES 2: UNDERSTANDING HARMONY (Common to all Branches) | L | T | P | C |
|---|---|---|---|---|---|
| 24GE301 | | 2 | 1 | 0 | 3 |

**OBJECTIVES:**

**Students completing this course are expected to:**

- Development of a holistic perspective based on self-exploration about themselves (human beings), family, society and nature/existence.
- Understanding (or developing clarity) of the harmony in the human being, family, society, and nature/existence
- Strengthening of self-reflection.
- Development of commitment and courage to act.

| UNIT-I | NEED, BASIC GUIDELINES, CONTENT AND PROCESS FOR VALUE EDUCATION | 9 |
|---|---|---|

Purpose and motivation for the course, recapitulation from Universal Human Values-I

- Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration
- Continuous Happiness and Prosperity- A look at basic Human Aspirations
- Right understanding, Relationship and Physical Facility- The basic requirements for fulfilment of aspirations of every human being with their correct priority
- Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
- Method to fulfil the above human aspirations: Understanding and living in harmony at various levels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking

| UNIT-II | UNDERSTANDING HARMONY IN THE HUMAN BEING – HARMONY IN MYSELF! | 9 |
|---|---|---|

Understanding human being as a co-existence of the sentient 'I' and the material 'Body'

- Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
- Understanding the body as an instrument of 'I' (I being the doer, seer and enjoyer)
- Understanding the characteristics and activities of 'I' and harmony in 'I'
- Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
- Programs to ensure Sanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss programs for ensuring health vs dealing with disease

| UNIT-III | UNDERSTANDING HARMONY IN THE FAMILY AND SOCIETY-HARMONY IN HUMAN-HUMAN RELATIONSHIP | 9 |
|---|---|---|

Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship

- Understanding the meaning of Trust; Difference between intention and competence
- Understanding the meaning of Respect; Difference between respect and differentiation; the other salient values in relationship
- Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, Fearlessness (trust) and co-existence as comprehensive Human Goals
- Visualizing a universal harmonious order in society- Undivided society, Universal order-from family to world family.

Include practice sessions to reflect on relationships in family, hostel and institutes extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives.

| UNIT-IV | UNDERSTANDING HARMONY IN NATURE AND EXISTENCE - WHOLE EXISTENCE AS COEXISTENCE | 9 |
|---|---|---|

Understanding the harmony in nature

- Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature
- Understanding Existence as Co-existence of mutually interacting units in all-pervasive space
- Holistic perception of harmony at all levels of existence.
- Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

| UNIT-V | IMPLICATIONS OF THE ABOVE HOLISTIC UNDERSTANDING OF HARMONY IN PROFESSIONAL ETHICS | 9 |
|---|---|---|

Natural acceptance of human values

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

Include practice exercises and case studies will be taken up in practice (tutorial) sessions eg. To discuss the conduct as an engineer or scientist etc.

**OUTCOMES:** After successful completion of the course, the students will be able to

| | |
|---|---|
| **CO1** | be aware of themselves, and their surroundings (family, society, nature). |
| **CO2** | be more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind. |
| **CO3** | have better critical ability |
| **CO4** | become sensitive to their commitment towards what they have understood (human values, human relationships, and human society). |
| **CO5** | be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction. |

**TEXT BOOKS:**

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, NewDelhi, 2010.

**REFERENCES:**

1. A Nagaraj, "Jeevan Vidya: Ek Parichaya", Jeevan Vidya Prakashan, Amarkantak,1999.
2. E. F Schumacher, "Small is Beautiful", Vintage classics, London, 1993.
3. A.N. Tripathi, "Human Values", New Age Intl. Publishers, New Delhi, Third Edition 2020.
4. Maulana Abdul Kalam Azad, "India Wins Freedom", Oriental blackswan private limited, Hyderabad, 2020.
5. Mahatma Gandhi, "Hind Swaraj or Indian Home Rule", Maheswari Publications, Delhi, 2020.
6. Romain Rolland, "The life of Vivekananda and the universal gospel", Publication house of Ramakrishna Math, Kolkata, Thirty second edition 2018.
7. Romain Rolland, "Mahatma Gandhi: The man who become one with the universal being ", Srishti Publishers & Distributors, New Delhi, Sixth Edition 2013.

8. Heaton, Dennis P. "The story of stuff." (2010): 553-556.
9. Gandhi, Mohandas Karamchand, “The story of my experiments with truth: An autobiography”, Om Books International, 2018.
10. Andrews, Cecile, “Slow is beautiful: new visions of community, leisure, and joie de vivre”, New society publishers, 2006.
11. Kumarappa, Joseph Cornelius, “The economy of permanence. CP”, All India Village Industries Assn., 1946.

| Course Code | DISCRETE MATHEMATICS | L | T | P | C |
|---|---|---|---|---|---|
| 24MA301 | (Common to B.E. CSE, B.Tech. IT and AIML) **(Theory Course)** | 3 | 1 | 0 | 4 |

**OBJECTIVES**

**The course will enable the learners to:**

- describe the arguments using connectives and rules of inference.
- introduce the basic concept of counting and generating functions.
- construct recurrence relations for mathematical models.
- define the graphs and its models.
- understand the concept of group theory, Lattices and Boolean algebra.

**UNIT I LOGIC AND PROOFS 12**

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

**UNIT II COMBINATORICS 12**

Mathematical induction - Strong induction and well ordering - The basics of counting - 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 - Definitions and examples of Rings and Fields.

**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**

**COURSE OUTCOMES**

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

CO1: examine the validity of the arguments.

CO2: apply various proof techniques and principles using analytic and combinatorial methods.

CO3: develop the recurrence relation for the sequence.

CO4: implement graph theory techniques to solve real time problems.

CO5: apply the concepts of groups, rings, and fields in solving algebraic problems.

CO6: solve problems in Lattices and Boolean algebra.

**TEXT BOOKS**:


1. K. H. Rosen, "Discrete Mathematics and its Applications", 8th Edition, Tata McGraw Hill Pub. Co. Ltd., New Delhi, Special Indian Edition, 2021.
2. J. P. Tremblay, and R. Manohar. " Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill Pub. Co. Ltd, New Delhi, 30th Reprint, 2017.


**REFERENCES:**


1. R.P. Grimaldi, "Discrete and Combinatorial Mathematics: An Applied Introduction", 5th Edition, Pearson Education Asia, New Delhi, Reprint 2019.
2. S. Lipschutz, and Mark Lipson., "Discrete Mathematics", Schaum's Outlines, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 4th Edition, 2021.
3. T. Koshy, "Discrete Mathematics with Applications", Elsevier Publications, 1st Edition, 2014.

| 24CS311 | APTITUDE AND CODING SKILLS – I<br>(Common to All Branches) | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 1.5 |

**OBJECTIVES:**

**The Course will enable learners to:**

- Develop vocabulary for effective communication and reading skills.
- Build the logical reasoning and quantitative skills.
- Develop error correction and debugging skills in programming.

**List of Exercises:**

1. **English – Phase I**

Vocabulary: Synonyms, Antonyms, Grammar: Subject-Verb Agreement, Tenses and Articles, Prepositions and Conjunctions, Speech and Voices, Comprehension: Inferential and Literal Comprehension, Contextual Vocabulary, Comprehension ordering

2. **Logical Reasoning – Phase I**

Deductive Reasoning: Coding deductive logic, Directional sense, Blood relations, Objective Reasoning, Selection decision tables, Puzzles, Inductive reasoning: Coding pattern and Number series pattern recognition, Analogy and Classification pattern recognition, Abductive Reasoning: Logical word sequence, Data sufficiency

3. **Quantitative Ability - Phase I**

Basic Mathematics: Divisibility, HCF and LCM, Numbers, decimal fractions and power, Applied Mathematics: Profit and Loss, Simple and Compound Interest, Time, Speed and Distance, Engineering Mathematics: Logarithms, Permutation and Combinations, Probability

4. **Automata Fix – Phase I**

Logical, Compilation and Code reuse

**TOTAL: 45 PERIODS**

**OUTCOMES:**

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

**CO1:** Develop vocabulary for effective communication skills.
**CO2:** Build the logical reasoning enhance critical thinking.
**CO3:** Develop error correction and debugging skills in programming.
**CO4:** Apply programming skills to develop programs efficiently
**CO5:** Solve problems using quantitative skills
**CO6:** Develop effective reading and listening skills.

| 24GE311 | PRODUCT DEVELOPMENT LAB - I<br>(Design Thinking)<br>(Common to All Branches) | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 2 | 1 |

**OBJECTIVES:**

**The Course will enable learners to:**

- Identify any gaps in the literature, such as open questions or conflicts in previous studies.
- Identify the need for additional research and areas of prior research to prevent duplication of effort.
- encourage the rapid and creative generation of diverse ideas within a limited timeframe, promoting innovation, critical thinking, and problem-solving in relation to a defined problem or research area.

**DESCRIPTION**

The students may be grouped into a batch of strength 3 or 4 to work under a project supervisor. The students learn to observe, empathize and ideate innovative solutions to real-world challenges. The student batches should identify a proposed work and will do literature review to develop prototype idea. Further at the end of the semester they will make a final presentation to exhibit the Identified literature gap.

**LIST OF ACTIVITIES:**

1. Conduct a literature review on the identified research area.
2. Identify the research gap from the literature review conducted.
3. Brain storming to be done to generate a large number of ideas within a specific timeframe.
4. Present the literature review conducted and identified research gap in relation to the research problem being investigated.

**TOTAL: 30 PERIODS**

**OUTCOMES:**

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

**CO1:** Identify, collect, and interpret relevant scholarly literature in the chosen research area.

**CO2:** Evaluate existing research to identify gaps and formulate precise research questions.

**CO3:** Apply brainstorming techniques to generate innovative and diverse research ideas. CO4: Analyze reviewed literature and research gap to effectively present a research problem with clarity and rationale.

**CO5:** Develop skills in using evidence to create and present an engaging and critical argument.

| 24MC301 | INDIAN CONSTITUTION | L | T | P | C |
|---|---|---|---|---|---|
| | | 1 | 0 | 0 | 0 |

**OBJECTIVES:**

**The Course will enable learners to:**

- To have some knowledge about Indian Constitution.
- To understand the concept of fundamental rights
- To learn about Lok Sabha and Rajya Sabha
- To have some knowledge about Legislative Assembly and Legislative Council
- To learn about Local Self Government

| UNIT I | INTRODUCTION | |
|---|---|---|

Meaning and Importance of Constitution, Preamble and Salient Features of the Constitution

| UNIT II | FUNDAMENTAL RIGHTS | |
|---|---|---|

Fundamental Rights, Right to Equality, Right to Freedom, Right against exploitation, Right to freedom of religion, Cultural and Educational Rights, Right to Constitutional Remedies and Duties, Directive Principles of State Policy.

| UNIT III | LOK SABHA AND RAJYA SABHA | |
|---|---|---|

Union Government – Lok Sabha and Rajya Sabha Composition, Powers, and functions: The President, The Prime Minister, and Supreme Court: Role Position and Powers/ functions.

| UNIT IV | LEGISLATIVE ASSEMBLY AND LEGISLATIVE COUNCIL | |
|---|---|---|

State Government - Legislative Assembly and Legislative Council: Composition, Powers and functions: The Governor, Chief Minister and High Court: Role, Position and Powers/ functions

| UNIT V | LOCAL SELF GOVERNMENT | |
|---|---|---|

Local self-Government, Panchayat Raj System in India; Election Commission; Public Service Commissions, Role, powers, and function

**OUTCOMES:**

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

CO1: Interpret the knowledge on Indian Constitution.
CO2: Demonstrate the knowledge gained through fundamental rights concept.
CO3: Relate the concept of Lok Sabha and Rajya Sabha.
CO4: Illustrate the concept of Legislative Assembly and Legislative Council.
CO5: Analyze the concept of Local Self Government.

**TEXT BOOK:**

1. M V Pylee, An Introduction to The Constitution of India, Vikas Publishing House Pvt. Ltd., 5th Edition, 2007.

**REFERENCES:**

1. Durga Das Basu, Introduction to the Constitution of India, 19th Edition Reprint 2009.
2. Sharma, Brij Kishore, “Introduction to the Constitution of India”, Prentice Hall of India, 7th Edition, 2015.

# SEMESTER IV

| 24CS402 | DESIGN AND ANALYSIS OF ALGORITHMS (Common to CSE, IT and AIML ) | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 4 |

**OBJECTIVES:**

**The Course will enable learners to:**

- Critically analyse the efficiency of alternative algorithmic solutions for the same problem
- Illustrate brute force and divide and conquer design techniques.
- Explain dynamic programming for solving various problems.
- Apply greedy technique and iterative improvement technique to solve optimization problems
- Examine the limitations of algorithmic power and handling it in different problems.

| UNIT I | INTRODUCTION | 9+6 |
|---|---|---|

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

**List of Exercise/Experiments:**

1. Perform the recursive algorithm analysis.
2. Perform the non-recursive algorithm analysis.

| UNIT II | BRUTE FORCE AND DIVIDE AND CONQUER | 9+6 |
|---|---|---|

Brute Force - String Matching - Exhaustive Search - Knapsack Problem - Divide and Conquer Methodology – Binary Search – Merge sort – Quick sort - Multiplication of Large Integers – Closest-Pair and Convex Hull Problems - Transform and Conquer Method: Heap Sort

**List of Exercise/Experiments:**

1. Write a program to search an element using binary search
2. Write a program to sort the elements using merge sort and find time complexity.

| UNIT III | DYNAMIC PROGRAMMING | 9+6 |
|---|---|---|

Dynamic programming – Principle of optimality – Floyd‘s algorithm – Multi stage graph - Optimal Binary Search Trees - Longest common subsequence - Matrix-chain multiplication – Travelling Salesperson Problem – Knapsack Problem and Memory functions.

**List of Exercise/Experiments:**

1. Solve Floyd’s algorithm
2. Write a program to find the longest common subsequence

| UNIT IV | GREEDY TECHNIQUE AND ITERATIVE IMPROVEMENT | 9+6 |
|---|---|---|

Greedy Technique – Prim‘s algorithm and Kruskal’s Algorithm – Huffman Trees. The Maximum-Flow Problem – Maximum Matching in Bipartite Graphs - The Stable marriage Problem

**List of Exercise/Experiments:**

1. Write a program to find minimum spanning tree using Prim’s algorithm
2. Implement Kruskal’s algorithm to find minimum spanning tree

| UNIT V | BACKTRACKING AND BRANCH AND BOUND | 9+6 |
|---|---|---|

P, NP NP- Complete and NP Hard Problems. Backtracking – N-Queen problem - Subset Sum Problem. Branch and Bound – LIFO Search and FIFO search - Assignment problem – Knapsack Problem - Approximation Algorithms for NP-Hard Problems – Travelling Salesman problem

**List of Exercise/Experiments:**

1. Write a program to implement sum of subset problem.
2. Solve knapsack problem using branch and bound technique

**TOTAL: 45+30=75 PERIODS**

**OUTCOMES:**

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

**CO1:** Understand the different algorithm design paradigms.

**CO2:** Design algorithms for real world problems using algorithmic design techniques.

**CO3:** Analyse the efficiency of simple recursive and non-recursive algorithms.

**CO4:** Analyse the algorithm's worst, best and average case behaviour in terms of time and space.

**CO5:** Understand the approximation algorithms for solving NP Hard problems

**CO6:** Solve the problems by selecting suitable algorithmic design techniques.

**TEXT BOOKS:**


1. Anany Levitin, Introduction to the Design and Analysis of Algorithms, Third Edition, Pearson Education, 2012.
2. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Computer Algorithms/ C++, Second Edition, Universities Press, 2019.


**REFERENCES:**


1. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, Introduction to Algorithms, Third Edition, PHI Learning Private Limited, 2012.
2. S. Sridhar, Design and Analysis of Algorithms, Oxford university press, 2014.
3. http://nptel.ac.in/


**LIST OF EQUIPMENTS:**

1. Standalone PC with C/C++/Java

| 24IT401 | MANAGING CLOUD AND CONTAINERIZATION | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 2 | 4 |

**COURSE OBJECTIVES:**

**The Course will enable the learners:**

- To understand the basics of cloud computing, the evolution of AWS from existing technologies, and the services provided by AWS.
- To learn about AWS security services and Identity and Access Management (IAM), including IAM users, groups, roles, and policies.
- To acquire skills in using Amazon S3 for cloud storage and AWS EC2 for compute services, including managing instances, storage classes, and lifecycle management.
- To understand networking fundamentals and implement virtual private clouds (VPCs), load balancing with different types of load balancers, and auto scaling to optimize resources and enhance security.
- To learn DevOps concepts and benefits, use Docker for containerization, and integrate AWS container services and CI/CD pipelines for automated system updates and lifecycle management.

| UNIT I | INTRODUCTION TO AWS | 9+6 |
|---|---|---|

Introduction to AWS (Cloud basics) - Introduction to Cloud Computing, Services provided by AWS, Future of AWS, AWS Account Creation, Identity & Access Management - AWS Security Services Introduction, Introduction & Function of IAM, IAM users, groups, roles, MFA, Types of policies in IAM.

**List of Exercises:**

1. Create an IAM group named 'Server-L1-Team' with 'AmazonEC2ReadOnlyAccess' and 'AutoScaling ReadOnlyAccess' policies, and add an IAM user named 'Server-L1- User1' to the group.
2. Create an IAM role named 'DemoUser' with 'ec2.amazonaws.com' as the trust entity, and attach the 'AmazonS3FullAccess' and 'Amazon VPC ReadOnlyAccess' policies.
3. Enable MFA for an IAM user and set password policies to include requirements such as at least one uppercase letter, one lowercase letter, one number, and one special character.
4. Creating Custom policy and inline policy using any one service (EC2 or S3)

| UNIT II | AMAZON S3 | 9+6 |
|---|---|---|

Amazon S3 - Cloud storage, Types, Benefits, Bucket permission & Object permission, Static website hosting, Object versioning, Storage Classes, Life Cycle management.

**List of Exercises:**

1. Create a new S3 bucket in the Frankfurt region and upload a text file named 'eventlogs.txt'.
2. Disable "Block Public Access" for the bucket and enable public read access for the 'eventlogs.txt' file.
3. Host a static webpage in the S3 bucket using the static website hosting feature. Also mention the Life Cycle plan applied for the same S3 bucket created.

| UNIT III | AWS ELASTIC COMPUTE CLOUD | 9+6 |
|---|---|---|

AWS Elastic Compute Cloud - AWS EC2 Introduction, EC2 Instances creation, EC2 Instance protection, EBS, Snapshots, MyAMI, EIP.

**List of Exercises:**

1. Create a 5 GB EBS volume, attach it to a Windows EC2 instance, and partition the EBS volume.
2. Launch a Linux EC2 instance with a t2.micro instance type and demonstrate the remote connection to the EC2 instance. Ensure Protection by enabling Stop protection and termination protection.
3. Create an EC2 instance in the "us-east-1" region with the following requirements - Name tag and key pair name: "ec2instance1", AMI: "Amazon Linux 2023", Instance type: t2.micro or t3.micro, Allow SSH (port 22) traffic for PuTTY remote connection, Allow HTTP (port 3389) traffic from the internet for web requests.

| UNIT IV | VIRTUAL PRIVATE CLOUD | 9+6 |
|---|---|---|

Virtual Private Cloud - Networking Fundamentals, VPC and its Components, Create VPC components, Public, Private Subnets, Elastic Load Balancers - Introduction, Benefits, Types of load balancers, Classic Load Balancer, Application Load Balancer, Network & Gateway Load Balancer, AWS Autoscaling - Types of Scaling Policies, how autoscaling works, Launch Configuration, Autoscaling Group. AWS Cloud Front - Introduction and Benefits of CloudFront, working with distributions, working with policies, Adding, removing, or replacing content.

**List of Exercises:**

1. Configure an AWS Application Load Balancer to evenly distribute traffic to EC2 instances across multiple availability zones within the Ohio region.
2. Create a launch template and auto-scaling group in the eu-west-3 region to facilitate dynamic scaling of EC2 instances based on demand.
3. Configure AWS CloudFront to deliver website content stored in an S3 bucket located in the ap-northeast-1 region to users across all edge locations, optimizing content delivery and reducing latency.

| UNIT V | DOCKER AND AWS CONTAINER SERVICES | 9+6 |
|---|---|---|

Docker introduction, Docker Architecture, Images and containers, Docker Run Static sites. Docker & AWS Container Services - Docker Images creations, Images from Docker Files, Usage of Docker Networks, Usage of Docker Composes, What is AWS ECR and How it works?, What is AWS ECS and How it works?, What is AWS Fargate and How it works?, What is AWS EKS and How it works?

**List of Exercises:**

1. Deploy an AWS ECS cluster with infrastructure based on the AWS EC2 launch type in the Tokyo region, facilitating containerized application deployment and management.
2. Store a Docker image in the AWS Elastic Container Registry (ECR), providing a secure and scalable repository for managing Docker images and facilitating container deployments on AWS services like ECS and EKS.
3. Create a customized Docker image of Nginx using Docker file and Host a static website using the same.

**TOTAL: 45+30=75 PERIODS**

## COURSE OUTCOMES:

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

**CO1:** Demonstrate the basic global infrastructure of the AWS Cloud, including regions, availability zones, edge locations, and core AWS services.

**CO2:** Configure and manage AWS Identity and Access Management (IAM) for secure user, group, role, and policy management, including MFA and custom policies.

**CO3:** Deploy and manage Amazon S3 and EC2 services, including storage classes, object lifecycle management, instance provisioning, and EBS volume management.

**CO4:** Design and implement networking solutions using Virtual Private Cloud (VPC), Elastic Load Balancing, Auto Scaling, and CloudFront for optimized performance and scalability.

**CO5:** Apply Docker architecture concepts, create and manage containerized applications, and integrate Docker with AWS container services like ECS, ECR, Fargate, and EKS.

**CO6:** Apply best-fit AWS services for different application workloads, ensuring cost-efficiency, high availability, and scalability across diverse use cases.

## TEXTBOOKS:

1. Mark Wilkins, “Learning Amazon Web Services (AWS): A Hands-On Guide to the Fundamentals of AWS

Cloud", 2019.
2. Sean P. Kane, Karl Matthias, "Docker: Up & Running: Shipping Reliable Containers in Production", O'Reilly Media Inc, 2015.
3. Jennifer Davis and Ryn Daniels, "Effective DevOps: Building a Culture of Collaboration, Affinity, and Tooling at Scale", 2016, O'Reilly Media Inc.
4. Sunil Gulabani, "Amazon Web Services Bootcamp: Develop a Scalable, Reliable, and Highly Available Cloud Environment with AWS",Packt Publishing, 2018.
5. Amit Shah and Aurobindo Sarkar,"Learning AWS", Packt Publishing, 2017.

**REFERENCES:**

1. Sean Keery, Clive Harber, Marcus Young, "Implementing Cloud Design Patterns for AWS", Second Edition, Packt Publishing, 2019.
2. Michael Charge "Docker Easy: The Complete Guide on Docker World for Beginners", 2020.
3. NikitSwaraj, "AWS Automation Cookbook" Packt Publishing Limited, 2017.

**SOFTWARE REQUIREMENTS:**

AWS Cloud Service

| 24IT402 | WEB DEVELOPMENT FRAMEWORKS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 3 | 4.5 |

**COURSE OBJECTIVES:**

**The Course will enable the learners:**

- To understand web semantics and related tools and framework
- Able to get hands on latest JS based web frameworks
- To develop a scalable and responsive web application
- To develop an industry ready application web enterprise feature

| UNIT I | ADVANCED TYPESCRIPT | 9+9 |
|---|---|---|

Introduction to HTML5 and CSS3, Media Queries, JS, DOM, BootStrap, Variables, Loops, Operators, Scope, Hoisting, Arrays, Spread, REST, DeStructuring

Introduction, Advantage of Using TS over JS, and where to Use and not to use TS - Understanding the Compiler (Transpiler), and its options, Scope of TS - Variable Scopes, Static Data Types - String, Number,Interface, Date - Union, Tuple, Undefined Data Types, Unknown vs any vs Never - Object Oriented , Arrow Funcions - Types, KeyOf, TypeOf, InstanceOf ,Narrowing, Conditional Types - Generics,Enum ,Required / Partial / Optional - Arrays, Modules ,Async Processing w Call backs ,Type Inference, Type Compatability, Utility Type - Unit Testing,TSLint

**List of Exercise/Experiments**

1. Create a TS Object for Bank Account (w attributes like à customer name, account type, balance, data of creation, bank name, branch name, pan card number). Using JS Object keyword, try to perform following activities
    - List down all the entries of the bank object
    - Check the existence of a key
    - If key found, get the value for the key
2. Spread Operator
    - Merge Customer and Account Arrays
    - Update the Customer Object with the new values
    - Develop a function that takes an Spread Argument and calculates total balance.

| UNIT II | INTRODUCTION TO REACTJS | 9+9 |
|---|---|---|

Introduction to React - ES6 Features,What is React?,React Features - Setting up React Development Environment:- Node.js and npm installation,Create React App,Project structure - JSX (JavaScript XML):- What is JSX?,JSX Syntax and Rules,JSX Expressions - Components in React:- Functional Components,Class Components,Props and PropTypes - State and Lifecycle :- State and setState,Lifecycle Methods,Mounting, Updating, and Unmounting,Handling Events in React - Event Handling in React :- Synthetic Events,Event Binding, - Conditional Rendering:-If-else Statements,Ternary Operator,Logical && Operator
Lists and Keys:-Rendering Lists,Keys and Reconciliation,Extracting Components.

**List of Exercise/Experiments**

1. A leading bank from APAC wants to modernize their banking services and decided to build a online multi channel mobile ecommerce platform. As part of the drive, starting building following feature set in a staggered model emplying ReactJS as front end library and associated libs from React eco system. Feature to be implemented are
    - User Login Page

- Account Summary
- Funds Transfer (within bank and outside bank)
- Recurring and Fixed deposits
- Letter of Credit
- Salary or 3rd Party Payment

2. Unit 2 Scope – Project Setup, Web App Layout Completion using BootStrap or Tailwind, Login Page Implementation, Landing Page Implementation, Authentication and Authorization Implementation.

| UNIT III | REACTJS COMPONENTS | 9+9 |
|---|---|---|

Forms and Controlled Components :- Form Handling in React, Controlled Components, Uncontrolled Components - Basic Hooks :- useState,useRef,useEffect, - Routing in React:- Introduction to React Router,Route, Link, and Switch Components, Route Parameters,useNavigate,useParams, - REST API – Axios GET/PUT/Delete/Remove, Interceptor, Headers, Authorization Token, Promise and Observables (via rxjs)

**List of Exercise/Experiments**

1. Extend the Project developed in previous section with newly learnt concepts
    - Unit 3 Scope – Forms and Validation (React Form Validation), Integration of Back End Apis via Axios,API Security Implementaiton, Routes and Navigation with Priviate Routes, Usage of useEffect, UseContext hooks

| UNIT IV | REACT PRO TOOLKIT: ERROR MANAGEMENT, ABSTRACTIONS AND DATA HANDLING | 9+9 |
|---|---|---|

Error Handling :- Error Boundaries,componentDidCatch,Error Handling Strategies
Higher-Order Components (HOCs) :- What are HOCs?,Creating and Using HOCs,HOCs vs Render Props,Code Splitting and Lazy Loading,Server-Side Rendering - Data Fetching with React Query :- React Query,Introduction to React Query,Query Keys and Query Functions, Query Invalidation and Refetching.

**List of Exercise/Experiments**

1. Extend the Project developed in previous section with newly learnt concepts
    - Unit 4 Scope – Completion of Remaining Modules, Error Handling, HOC and AUX implementation, Lazy loaded components for improved performance
2. Extend the Project developed in previous section with newly learnt concepts

| UNIT V | REACT UNDER THE HOOD: TESTING, CONTEXT API, AND REDUX | 9+9 |
|---|---|---|

Testing React Components :- Introduction to Testing,Jest Framework,React Testing Library
Context API :- Creating Context,Providing and Consuming Context,useContext Hook
Redux Overview :- What is Redux?,Redux Principles,Single Source of Truth - Redux Actions and Reducers :- Redux Actions,Redux Reducers,Combining Reducers.

**List of Exercise/Experiments**

1. Extend the Project developed in previous section with newly learnt concepts
    - Unit 5 Scope – Unit Testing using JEST, Redux implementation for state management.

**Business Use Case Implementations**

1. Student Management System

2. Retail Bank System
3. eCommerce System
4. Student LMS Management System

**TOTAL: 45+45=90 PERIODS**

**COURSE OUTCOMES:**

After completing the course, students will have the ability to

**CO1.** Understand and apply modern web technologies including HTML5, CSS3, JavaScript, and advanced TypeScript concepts to build dynamic web components.

**CO2.** Develop responsive and modular front-end applications using ReactJS, including component creation, state management, and routing.

**CO3.** Implement advanced React features like hooks (useState, useEffect, useRef), React Router, and REST API integration using Axios for dynamic content handling.

**CO4.** Utilize higher-order components (HOCs), lazy loading, and server-side rendering to optimize and abstract React applications.

**CO5.** Perform unit testing using Jest and RTL, and manage global application state efficiently using Context API and Redux.

**CO6.** Design and deliver scalable and real-world enterprise web applications with complete user interface flow, security, and error handling.

**TEXTBOOKS:**

David Flanagan, Javascript The Definitive Guide, Paperback, 7th Edition, 2020.

David Choi ,Full-Stack React, TypeScript, and Node: Build cloud-ready web applications using React 17 with Hooks and GraphQL Paperback – Import, 18 December 2020.

Mehul Mohan, Advanced Web Development with React Paperback – 1 January 2020.

**E-RESOURCES:**

1. Parental Website - https://reactjs.org/
2. The Road to Learn React: Your journey to master plain yet pragmatic React.js by Robin Wieruch
3. Learning React: Functional Web Development with React and Redux by Alex Banks and Eve Porcello
4. Learning React by KirupaChinnathambi
5. "React Up & Running" by StoyanStefanov
6. https://www.edureka.co/reactjs-redux-certification-training
7. CodePen
8. CodeSandbox (Preferred)
9. Stackblitz

**LIST OF EQUIPMENTS:**

- NodeJS (v22.11.2)

- Github as code repository
- Visual studio code as IDE
- RTL as unit testing framework
- Responsive design w bootstrap
- ReactJS installation (v17)
- Chrome / FIreFox Browsers (latest)
- Responsive using Media Queries & Bootstrap Material&Antdesign
- Design based Apps

| Course Code | PROBABILITY AND STATISTICS<br>(Common to B.E. CSE, B.Tech. IT and AIML)<br>(Theory Course with Laboratory Component) | L | T | P | C |
|---|---|---|---|---|---|
| 24MA401 | | 3 | 0 | 2 | 4 |

**OBJECTIVES**

**The course will enable the learners to:**

- provide the necessary basic concepts of random variables and introduce some standard distributions.
- comprehend the concepts of joint distributions, marginal and conditional distributions.
- test the hypothesis for small and large samples.
- introduce the concepts of analysis of variances.
- understand the concept of statistical quality control.

**UNIT I ONE-DIMENSIONAL RANDOM VARIABLES 15**

Basic probability, Independent events, Conditional probability (definition) - Random variable - Discrete and continuous random variables - Moments - Moment generating functions - Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

**List of Exercises/Experiments using R Programming:**

1. Finding conditional probability.
2. Finding mean, variance and standard deviation.

**UNIT II TWO-DIMENSIONAL RANDOM VARIABLES 15**

Joint distributions - Marginal and conditional distributions - Covariance - Correlation and linear regression - Transformation of random variables.

**List of Exercises/Experiments using R Programming:**

1. Finding marginal density functions for discrete random variables.
2. Calculating correlation and regression.

**UNIT III TESTING OF HYPOTHESIS 15**

Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample tests based on Normal distribution for single mean and difference of means - Tests based on t and F distributions for mean and variance - Chi-square test- Contingency table (test for independent) - Goodness of fit.

**List of Exercises/Experiments using R Programming:**

1. Testing of hypothesis for given data using z - test.
2. Testing of hypothesis for given data using t - test.

**UNIT IV DESIGN OF EXPERIMENTS 15**

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

**List of Exercises/Experiments using R Programming:**

1. Perform one-way ANOVA test for the given data.

2. Perform two-way ANOVA test for the given data.

**UNIT V STATISTICAL QUALITY CONTROL 15**

Control charts for measurements ($\bar{X}$ and R charts) - Control charts for attributes (p, c and np charts) - Tolerance limits.

**List of Exercises/Experiments using R Programming:**

1. Interpret the results for $\bar{X}$- Chart for variable data.
2. Interpret the results for R-Chart for variable data.

**TOTAL: 75 PERIODS**

**COURSE OUTCOMES**

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

CO1: compute the statistical measures of standard distributions.

CO2: apply joint, marginal and conditional distributions to solve practical problems

CO3: determine the correlation and regression for two dimensional random variables

CO4: employ the concept of testing of hypothesis to solve real life problems.

CO5: apply the concept of analysis of variance for various experimental designs.

CO6: prepare the control charts for variables and attributes for analyzing the data.

**TEXTBOOKS**:


1. R.A. Johnson, I. Miller and J. Freund, "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 9th Edition, 2023.
2. J.S. Milton and J.C. Arnold, "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2019.


**REFERENCES:**


1. J. L. Devore, "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 9th Edition, Reprint 2020.
2. S. M. Ross, "Introduction to Probability and Statistics for Engineers and Scientists", 6th Edition, Elsevier, 2020.
3. M. R. Spiegel, J. Schiller and R.A. Srinivasan, "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill, 4th Edition, 2013.
4. R. E. Walpole, R. H. Myers, S.L. Myers and K. Ye, "Probability and Statistics for Engineers and Scientists". Pearson Education, Asia, 9th Edition, Reprint 2021.

| 24CS411 | APTITUDE AND CODING SKILLS – II<br>(Common to All Branches) | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 3 | 1.5 |

**OBJECTIVES:**

**The Course will enable learners to:**

- Develop advanced vocabulary for effective communication and reading skills.
- Build an enhanced level of logical reasoning and quantitative skills.
- To develop error correction and debugging skills in programming.
- To apply data structures and algorithms in problem solving.

**List of Exercises:**

1. **English – Phase II**

Vocabulary: Synonyms, Antonyms, Grammar: Subject-Verb Agreement, Tenses and Articles, Prepositions and Conjunctions, Speech and Voices, Comprehension: Inferential and Literal Comprehension, Contextual Vocabulary, Comprehension ordering

2. **Logical Reasoning – Phase II**

Deductive Reasoning: Coding deductive logic, Directional sense, Blood relations, Objective Reasoning, Selection decision tables, Puzzles, Inductive reasoning: Coding pattern and Number series pattern recognition, Analogy and Classification pattern recognition, Abductive Reasoning: Logical word sequence, Data sufficiency

3. **Quantitative Ability - Phase II**

Basic Mathematics: Divisibility, HCF and LCM, Numbers, decimal fractions and power, Applied Mathematics: Profit and Loss, Simple and Compound Interest, Time, Speed and Distance, Engineering Mathematics: Logarithms, Permutation and Combinations, Probability

4. **Automata Fix – Phase II**

Logical, Compilation and Code reuse

5. **Automata - Phase II**

Data Structure Concepts: Array and Matrices, Linked list, String processing and manipulation, Stack/Queue, Sorting and Searching

Advanced Design and Analysis Techniques: Greedy Algorithms, Minimum Spanning Trees, String Matching, Divide and Conquer, Computational Geometry

**TOTAL: 45 PERIODS**

**OUTCOMES:**

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

**CO1:** Develop advanced vocabulary for effective communication skills.
**CO2:** Build an enhanced level of logical reasoning and quantitative skills.
**CO3:** Develop error correction and debugging skills in programming.
**CO4:** Apply data structures and algorithms in problem solving.
**CO5:** Develop advanced vocabulary for effective reading skills
**CO6:** Apply advanced algorithm design techniques to develop programs

| 24GE411 | PRODUCT DEVELOPMENT LAB - II<br>(Functional Design)<br>(Common to All Branches) | L | T | P | C |
|---|---|---|---|---|---|
| | | 0 | 0 | 2 | 1 |

**OBJECTIVES:**

**The Course will enable learners to:**

- To accurately capture the expectations, needs, and constraints of stakeholders to ensure that the system being developed aligns with user goals and real- world usage scenarios.
- To visually represent the system's structure and functional relationships, enabling clearer communication, easier analysis, and better planning of system architecture and workflow.
- To create a precise and comprehensive reference document that guides development, ensures clarity, and serves as a basis for verification, validation, and future system enhancements.

**DESCRIPTION**

The students may be grouped into a batch of strength 3 or 4 to work under a project supervisor. Further at the end of the semester they will make a final presentation to exhibit the functional design and the process to develop a product.

**LIST OF ACTIVITIES:**

1. Understand and document functional requirements based on stakeholder needs.
2. Map out how functions interact and relate to each other using functional block diagrams or flowcharts.
3. Write detailed specification describing each function's role, behavior, constraints, and expected outcomes.
4. Check if defined functions meet the intended requirements and can be validated/tested.
5. Present the design concepts carried out for the identified research gap in relation to the research problem being investigated.

**TOTAL: 30 PERIODS**

**OUTCOMES:**

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

**CO1:** Interpret stakeholder needs and document comprehensive functional requirements for the proposed system.

**CO2:** Develop functional block diagrams or flowcharts to represent system interactions and functional relationships.

**CO3:** Analyze functional specifications that define roles, behaviors, constraints, and performance expectations for each function.

**CO4:** Evaluate the defined functional model through verification and validation techniques to ensure alignment with original requirements.

**CO5:** Analyze and present functional design solutions aligned with the identified research problem and gap.

**LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS**

| S. No. | Description of Equipment | Quantity |
|---|---|---|
| 1 | CNC Router | 1 No |
| 2 | 3D Printer | 1 No |
| 3 | 3D Scanner | 1 No |

## PROFESSIONAL ELECTIVE VERTICALS – DATA SCIENCE

| 24IT907 | FOUNDATIONS OF DATA SCIENCE | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES:**

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

| UNIT I | INTRODUCTION | 9 |
|---|---|---|

Data Science: Benefits and uses – 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- Basic Statistical descriptions of Data

| UNIT II | DESCRIBING DATA | 9 |
|---|---|---|

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

| UNIT III | 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 r2 –multiple regression equations –regression towards the mean

| UNIT IV | 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 V | 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

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

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

**CO1:** Understand the data science process

**CO2:** Compare different types of data description for data science process

**CO3:** Gain knowledge on relationships between data

**CO4:** Implement Python Libraries for Data Wrangling

**CO5:** Apply visualization Libraries in Python to interpret and explore data

**CO6:** Apply data science concepts to solve real world problems

**TEXTBOOKS**


1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing Data Science", Manning Publications, 2016. (Unit I)
2. Robert S. Witte and John S. Witte, "Statistics", Eleventh Edition, Wiley Publications, 2017. (Units II and III)
3. Jake VanderPlas, "Python Data Science Handbook", O'Reilly, 2016. (Units IV and V)


**REFERENCE:**


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

## PROFESSIONAL ELECTIVE VERTICALS – CYBER SECURITY

| 24IT913 | SOCIAL NETWORK SECURITY | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**OBJECTIVES:**

**The Course will enable learners to:**

- Learn the Concepts of Social Network Security
- Understand the methods of Social Network Anonymization
- Learn the techniques for security and privacy in social networks
- Learn the security challenges in social networks
- Explore the Tools to learn about the social network security implementation

| UNIT I | INTRODUCTION TO SOCIAL NETWORK SECURITY | 6+6 |
|---|---|---|

Introduction – Social Networking Applications – Social media Websites – Social Network Representation –Building Social Authority –Privacy and Information sharing – Controlling Application privacy – Cybercrime – Information Leakage – False information – Content Management in Social Networks

**List of Exercise/Experiments:**

1. Explore a Social network analysis tools to learn about the users and networks
2. Learn a program / tool to illustrate information leakage

| UNIT II | SOCIAL NETWORK ANONYMIZATION | 6+6 |
|---|---|---|

Social Networks - Privacy in Social Networks – Social Network Representation – Social Network Analysis - Data Anonymization – Challenges in Anonymization – Privacy preservation – Social Network Anonymization Factors – Anonymization Algorithms – Link Anonymization techniques – Background Knowledge Attacks – Anonymity in Modern Social
Networks

**List of Exercise/Experiments:**

1. Experiment a link anonymization technique
2. Explore ARX anonymization tool

| UNIT III | ANALYZING AND SECURING SOCIAL NETWORKS | 6+6 |
|---|---|---|

Supporting Technologies - Aspects of Analyzing and Securing Social Networks - Techniques and Tools for Social Network Analytics - Social Network Analytics and Privacy Considerations - Access Control and Inference for Social Networks - Social Media Integration and Analytics Systems - Social Media Application Systems - Secure Social Media Systems - Secure Social Media Directions.

**List of Exercise/Experiments:**

1. Implement a program for network access control to illustrate malware attacks
2. Create a simple social network application to show authentication mechanisms
3. Create an application for the following scenario: “Social networking users are presented with two apparently similar emails or websites. They must first identify the differences between them and then decide which one is a scam attempting to steal their information or money.”

| UNIT IV | SECURITY CHALLENGES IN SOCIAL NETWORKS | 6+6 |
|---|---|---|

Identity manipulation – Threats from third party applications - Trust in Social Networking Sites - Viruses, Phishing Attacks and Malwares–Tracking users – Privacy of Data – Identity Federation Challenges –Social media threats – Location disclosure – Spoofing – Profile cloning – Fake product sale – Cyber bullying – Prevention Strategies

**List of Exercise/Experiments:**

1. Implement a program in python to estimate trust of social network users group
2. Write a SQL injection program in python/JAVA to handle session hijacking
3. Create an application using any social network platform to demonstrate profile cloning concept.

| **UNIT V** | **SOCIAL NETWORK SECURITY TOOLS** | **6+6** |
|---|---|---|

Analysis Tools for Social Media - AutoMap – Gephi – ORA Lite – ORA Pro – Wolfram Alpha – Social Media Data Collection –Blog Trackers –Crowd Tangle – MalTego – Pulse – SCRAAWL – Fact and Image Trackers – Google Fact Check Tools – Bot Mitigation – BotSlayer – Social Cyber Security

**List of Exercise/Experiments:**

1. Perform fact checking of social networking content using google fact checking tools
2. Explore a tool that helps protect websites from bot traffic and bot attacks.
3. Create a fake news tracker program to collect, detect and help visualize fake news data from any social network

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

**OUTCOMES:**

**Upon completion of the course, the students will be able to: CO1:**
Develop security applications of social networks.

**CO2:** Implement data anonymization techniques

**CO3:** Analyze and secure social networks

**CO4:** Apply security challenges in social networks

**CO5:** Develop security tools for social networks

**CO6:** Create newer social networking applications

**TEXTBOOKS:**


1. Brij B. Gupta, Somya Ranjan Sahoo, "Online Social Networks Security-Principles, Algorithm, Applications, and Perspectives", First Edition, 2021.
2. Bhavani Thuraisingham, SatyenAbrol, Raymond Heatherly, Murat Kantarcioglu, Vaibhav Khadilkar, Latifur Khan, "Analyzing and Securing Social Networks", First Edition, 2020.
2. B. K. Tripathy, Kiran Baktha, "Security, Privacy, and Anonymization in Social Networks: Emerging Research and Opportunities", IGI Global Publication, 2019.
3. Michael Cross, "Social Media Security, Leveraging Social Networking While Mitigating Risk", Elsevier Publication, First Edition, 2013.


**REFERENCES:**


1. El-Sayed M. El-Alfy ; Mohamed Eltoweissy ;Errin W. Fulp ; Wojciech Mazurczyk, "Nature-Inspired Cyber Security and Resiliency: Fundamentals, Techniques and Applications", IET Publication, 2019.
2. https://sites.google.com/view/social-cybersec/tools?pli=1
3. Yaniv Altshuler, "Security and Privacy in Social Networks", Springer , 2013.

**SOFTWARE REQUIREMENTS:**

1. Python
2. Shield Square BotSlayer
3. Google Fact Check Tools Ora-Pro

## PROFESSIONAL ELECTIVE VERTICALS – FULL STACK ENGINEERING

| 24IT901 | SOFTWARE TESTING AND AUTOMATION | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**OBJECTIVES:**

The Course will enable learners to:

- To introduce the basics and necessity of software testing.
- To provide various testing techniques along with concepts of software bugsand its impact.
- To develop and validate a test plan.
- To build a testing team required.
- To understand the need for and challenges in test automation and to developtesting scripts.

| UNIT I | TESTING PRINCIPLES AND AXIOMS | 6+6 |
|---|---|---|

Testing as a Process – Testing Axioms –Software Testing Principles – Origins and Cost ofDefects – Defect Classes and Examples – Developer/Tester Support of Developing a Defect Repository – Defect Prevention Strategies.

**List of Exercise/Experiments**

1. Flipped classroom on testing axioms.
2. Identify and analyze syntax error, semantic error, bug and defect for programs.
3. Identify the various types of errors, bugs and defects for a case study.

| UNIT II | BLACK BOX, WHITE BOX TESTING AND TEST ADEQUACY | 6+6 |
|---|---|---|

Test Case Design Strategies — Black Box Approach — Boundary Value Analysis — Equivalence Class Partitioning – State-Based Testing – User Documentation Testing – White Box Approach – Static Testing vs. Structural Testing – Code Functional Testing – Coverage and Control Flow Graphs — Covering Code Logic — Paths — Cyclomatic Complexity – Test Adequacy Criteria.

**List of Exercise/Experiments**

1. Flipped classroom on test adequacy criteria.
2. External learning – Exploring white box testing tools like veracode, eclemma, rcunit,cppunit, Junit, JSUnitetc.
3. Analyzing the cyclomatic complexity of code segments.
4. Assignments on white box testing tools like Selenium, Appium, Robotium and carrying out simple BBT and WBT using tools.
5. Solving problems related to cyclomatic complexity.

| UNIT III | LEVELS OF TESTING | 6+6 |
|---|---|---|

Unit Test – Planning – Designing the Unit Test Process – Running the Unit Tests and Recording Results — Integration Test Planning — Scenario Testing — Defect Bash Elimination System Testing – Acceptance Testing – Performance Testing – Regression Testing – Internationalization Testing –

Ad-Hoc Testing – Alpha, Beta Tests

**List of Exercise/Experiments**

1. External learning – Exploring the integration testing tools for various programming languages – VectorCAST/C++, CITRUS (Java), FitNesse (open source), Rational test integration tester, Protractor (Angular, Angular JS), Jasmine (JavaScript), Spock (Java) and the regression testing tools — Sahi Pro, Watir, IBM Rational Regression Tester, TestDrive etc.
2. Flipped classroom on alpha and beta testing.
3. Analyzing various levels of testing required for a software product.

| **UNIT IV** | **TEST MANAGEMENT** | **6+6** |
|---|---|---|

Organization Structures For Testing Teams — Testing Services — Test Planning Attachments – Locating Test Items – Test Management – Reporting Test Results – The Role of Three Groups in Test Planning and Policy Development – Introducing the Test Specialist – Skills Needed by a Test Specialist – Building a Testing Group.

**List of Exercise/Experiments**

1. Flipped classroom on reporting test results.
2. External learning – Exploring the organization structures and organizationalbehaviour in the context of software testing.
3. Analyzing how to build testing groups for various types of projects andorganizations.

| **UNIT V** | **TEST AUTOMATION** | **6+6** |
|---|---|---|

Software Test Automation – Skill Needed for Automation – Scope of Automation – Design and Architecture for Automation — Requirements for a Test Tool — Challenges in Automation – Test Metrics and Measurements – Project, Progress and Productivity Metrics – Maintenance of Documents During Testing.

**List of Exercise/Experiments**

1. Flipped classroom on Test metrics and measurements.
2. External learning – Exploring the risks involved in automated testing and exploringthe ways to improve your testing skills apart from using testing tools.
3. Practical — Install and learn popular software testing tools like Selenium, WinRunner, LoadRunner, Performance Tester etc.
4. Learning to write test scripts.

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

**COURSE OUTCOMES:**

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

**CO1:** Obtain an insight to software testing.

**CO2:** Apply both black box testing and whitebox testing.

**CO3:** Understand and applymultiple levels of testing.

**CO4:** Understand the role of a tester as an individual and as a team member.

**CO5:** Apply software testing for large projects using automated testing tools.

**CO6:** Maintain documentation on testing.

**TEXTBOOKS**


1. Paul C. Jorgensen, "Software Testing: A Craftsman's Approach",Fourth Edition, CRC Press, 2013.
2. Dorothy Graham, Mark Fewster, "Experiences of Test Automation: Case Studies of Software Test Automation", Pearson Education, 2012.


**REFERENCES:**


1. Glenford J. Myers, Tom Badgett, Corey Sandler, "The Art ofSoftware Testing", Third Edition, John Wiley & Sons, 2012.
2. Srinivasan Desikan, Gopalaswamy Ramesh, "Software Testing –Principles and Practices", Pearson Education, 2009.
3. Boris Beizer, "Software Testing Techniques", Dream Tech Press, 2009.
4. Mauro Pezze, Michal Young, "Software Testing and Analysis Process Principles and Techniques", Wiley India, 2008.
5. Ali Mili, Fairouz Chier, "Software Testing: Concepts and Operations", Wiley,2015.

## PROFESSIONAL ELECTIVE VERTICALS – MEDIA PROCESSING

| 24IT919 | AUGMENTED AND VIRTUAL REALITY | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 2 | 3 |

**OBJECTIVES:**

**The Course will enable learners to:**

- Get exposure on Augmented Reality.
- Introduce Virtual Reality and input and output devices.
- Acquire knowledge on computing architectures and modelling.
- Explore Virtual Reality programming and human factors.
- Learn various applications of Virtual Reality.

| UNIT I | AUGMENTED REALITY (AR) | 6+6 |
|---|---|---|

Introduction to Augmented Reality-Computer vision for AR-Interaction- Modelling and Annotation-Navigation-Wearable devices.

**List of Exercise/Experiments:**

1. Develop simple AR Application like snapchat.
2. Develop AR enabled simple applications like human anatomy visualization, DNA/RNA structure visualization.

| UNIT II | INTRODUCTION TO VIRTUAL REALITY (VR) AND INPUT AND OUTPUT DEVICES | 6+6 |
|---|---|---|

Introduction: The three I's of Virtual Reality - - Early commercial VR technology - The five classic components of a VR system. Input devices: Three-Dimensional position trackers - tracker performance parameters - ultrasonic trackers - optical trackers - Navigation and manipulation interfaces - gesture interfaces. Output devices: graphics displays - large-volume displays - sound displays.

**List of Exercise/Experiments**

1. Study of tools like Unity, Maya/3DS MAX/Blender.
2. Use the primitive objects and apply various projection types by handling camera.

| UNIT III | COMPUTING ARCHITECTURES AND MODELING OF A VR SYSTEM | 6+6 |
|---|---|---|

Computing architectures for VR: The rendering pipeline - The graphics rendering pipeline - The haptics rendering pipeline - PC graphics architecture - PC graphics accelerators - Graphics benchmarks - Distributed VR architectures - Multipipeline synchronization - Colocated rendering pipelines. Modeling: geometric modeling - kinematics modeling - physical and behavior modelling

**List of Exercise/Experiments**

1. Download objects from asset store and apply various lighting and shading effects.
2. Model three dimensional objects using various modelling techniques and apply textures over them

| UNIT IV | VR PROGRAMMING AND HUMAN FACTORS | 6+6 |
|---|---|---|

Toolkits and scene graphs - WorldToolKit - Model geometry and appearance - The WTK scene graph - Sensors and action functions - WTK networking - Java 3D - Model geometry and appearance - Java 3D scene graph - Sensors and behaviors - Java 3D networking - WTK and Java 3D performance comparison –Human factors in VR: Methodology and terminology
- user performance studies - VR health and safety issues - VR and society

**List of Exercise/Experiments**

1. Create three dimensional realistic scenes and develop simple virtual reality enabled mobile applications which have limited interactivity.
2. Add audio and text special effects to the developed application

| **UNIT V** | **APPLICATIONS OF VR** | **6+6** |
|---|---|---|

Medical Application of VR - Virtual anatomy-Triage and diagnostic - Surgery - VR in education
- VR and the Arts - Entertainment applications of VR - military VR applications - Army use of VR - VR applications in the Navy - Air force use of VR - Applications of VR in Robotics - Robot programming - Robot teleoperation

**List of Exercise/Experiments**

1. Develop VR enabled applications using motion trackers and sensors incorporating full haptic interactivity.
2. Develop VR/AR enabled applications with interactivity like E learning environment, Virtual walkthroughs and visualization of historic places.

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

**OUTCOMES**:

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

**CO1:** Understand Augmented Reality.

**CO2:** Explore different input and output devices used in Virtual Reality system.

**CO3:** Model the VR system.

**CO4:** Analyze about Google Toolkit's and Scene Graph.

**CO5:** Apply virtual reality in a variety of sectors.

**CO6:** Assess the effectiveness of VR in improving training outcomes and operational readiness

**TEXTBOOKS:**

1. Dieter Schmalstieg, Tobias Hollerer, “Augmented Reality: Principles & Practice”, Addison Wesley, 2016.
2. Grigore C. Burdea, Philippe Coiffet, “Virtual reality technology”, Wiley, Second Edition, 2017.

**REFERENCE:**

1. Sherman, William R & Craig, Alan B, “Understanding Virtual reality”, Elsevier India Private Limited, Noida, 2018.
2. Charles Palmer, John Williamson, “Virtual Reality Blueprints: Create compelling VR experiences for mobile”, Packt Publisher, 2018.

**SOFTWARE REQUIREMENTS:**

Unity, Maya/3DS MAX/Blender.

**PROFESSIONAL ELECTIVE VERTICALS**
**FINTECH AND WEB 3.0**

| 24IT925 | BLOCKCHAIN TECHNOLOGIES | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES:**

**The Course will enable the learners:**

- To understand how blockchain systems (mainly Bitcoin and Ethereum) work
- To securely interact with them
- To design, build, and deploy smart contracts and distributed applications,
- To integrate ideas from blockchain technology into their own projects.

| UNIT I | INTRODUCTION | 9 |
|---|---|---|

What is Blockchain, Types of Block Chain, What is Distributed Ledgers, Consensus Algorithm, Blocks, Transaction, Double spending etc Hashing Techniques, Block Hashing, Distributed Ledgers vs Centralised Controls Ledgers. What is BitCoin, how it works, public ledgers, Miners roles, Pros and Cons.

| UNIT II | CONSENSUS ALGORITHMS | 9 |
|---|---|---|

Consensus Algorithms - Proof of Work, Proof of Stake, practical Byzantine Fault Tolerance (pBFT), Istanbul Byzantine Fault Tolerant, Proof of Burn, Proof of Capacity, Proof of Elapsed Time Understanding between Permissioned vs Permission less Block Chain platforms - Data privacy - Authorization - Multi Partner Setup - Private
Channels.

| UNIT III | ETHEREUM AND SOLIDITY | 9 |
|---|---|---|

Solidity Introduction and Installation, Strings, Variables, Struct, Enums, Map, Events, Conversions, Ether Units, Payable, View, Pure Functions, Address, Functions, Function Modifiers, Fall back Function, Math and Crypto Functions, Object Oriented and Error Handling Understanding on EVM, Remix, Gas/Gas-limit, Accounts,
Address, Ethereum Value.

| UNIT IV | ETHEREUMS DAAPS DEVELOPMENT | 9 |
|---|---|---|

Installation of NodeJS -- Truffle suite -- Ganache -- Metamask -- Visual Studio Code Edition -- Solidity Compiler -- React Web Application Design and Development of
Web3 Apps using Daap Applications using Solidity on Ethereum Platform.

| UNIT V | REACT BASED WEB APPLICATION | 9 |
|---|---|---|

The solution will have React based web application as front end, which will communicate with deployed Smart Contracts via Web3js package. Use Case -
Academics, Financial Domain, Life Science Domain.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

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

**CO1 :** Understand the basic concepts and technology used for blockchain

**CO2 :** Apply the concepts of Bitcoin in real world applications

**CO3 :** Demonstrate the concepts of Consensus Algorithm

**CO4:** Implement Ethereum blockchain contract.

**CO5 :** Implement web3 apps using Solidity on Ethereum Platform

**CO6 :** Apply smart contract in real world applications

**TEXTBOOKS:**


1. Imran Bashir, "Mastering Blockchain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained", Second Edition, Packt Publishing, 2018.
2. A. Narayanan, J. Bonneau, E. Felten, A. Miller, S. Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press, 2016.


**REFERENCES:**


1. Arshdeep Bahga, Vijay Madisetti, "Blockchain Applications: A Hands On Approach", VPT, 2017.
2. Andreas Antonopoulos, Satoshi Nakamoto, "Mastering Bitcoin", O"Reilly, 2014.
3. Roger Wattenhofer, "The Science of the Blockchain" Create Space Independent Publishing, 2016.
4. Alex Leverington, "Ethereum Programming" Packt Publishing, 2017.

**PROFESSIONAL ELECTIVE VERTICALS**
**ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING**

| 24IT931 | REINFORCEMENT AND ENSEMBLE LEARNING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

**The Course will enable learners to:**

- Outline the concepts of Reinforcement Learning
- Solve problems using Monte Carlo Decision Process and Dynamic Programming.
- Implement problems using temporal difference learning.
- Apply functional approximation in reinforcement learning.

| UNIT I | INTRODUCITON | 9 |
|---|---|---|

Introduction - Elements of RL, History of RL- Limitation and Scope - Examples – Multi-arm Bandits – k-armed Bandit Problem – Action-Value Methods – Incremental Implementation – Nonstationary Problem – Optimistic Initial Values – Upper Confidence Bound Action Selection – Gradient Bandit Algorithms – Contextual Bandits.

| UNIT II | TABULAR SOLUTION METHODS | 9 |
|---|---|---|

Finite Markov Decision Processes – Dynamic Programming – Monte Caro Methods – Temporal Difference Learning.

| UNIT III | FUNCTION APPROXIMATION METHODS | 9 |
|---|---|---|

On-Policy Prediction with Approximation: Value-function Approximation – The Prediction Objective – Stochastic-gradient and Semi-gradient Methods - Linear Methods – Feature Construction for Linear Methods - Eligibility Traces: The $\lambda$-return – TD($\lambda$).

| UNIT IV | CORE ENSEMBLE METHODS | 9 |
|---|---|---|

Boosting - Boosting procedure – AdaBoost Algorithm – Examples and Issues - Bagging - Algorithm – Examples and Issues – Random tree Ensembles -Combination Methods - Averaging – Voting – Combining by learning – Other Combination methods – Relevant methods.

| UNIT V | ADVANCED ENSEMBLE METHODS | 9 |
|---|---|---|

Ensemble Pruning - Categories – Ordering based – Clustering based – Optimization based Clustering Ensembles - Categories – Similarity based – Graph based – Relabeling based – Transformation based.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

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

**CO1:** Analyze the basics and history of reinforcement learning using examples like Multi-arm Bandits

**CO2:** Use tabular methods for solving Markov Decision Processes.

**CO3:** Evaluate function approximation methods for on-policy prediction.

**CO4:** Design and compare ensemble methods like boosting and bagging

**CO5:** Analyze and combine advanced ensemble methods for pruning and clustering

**CO6:** Apply ethical principles and communicate effectively in presenting learning methods

**TEXT BOOKS:**


1. Sutton R. S. and Barto A. G., "Reinforcement Learning: An Introduction", MIT Press, Second Edition, 2020.
2. Zhi-Hua Zhou. Ensemble Methods Foundations and Algorithms , First Edition, Chapman & Hall/CRC Machine Learning & Pattern Recognition, 2012.


**REFERENCES:**


1. Kevin Murphy, “Machine Learning - A Probabilistic Perspective” , MIT press, 2012.
2. Christopher Bishop, “Pattern Recognition and Machine Learning”, Springer, 2006.
3. Phil Winder, “Reinforcement Learning: Industrial Applications of Intelligent Agents“. Oreilly, 2021.

## PROFESSIONAL ELECTIVE VERTICALS – QUANTUM COMPUTING

| 24IT937 | INTRODUCTION TO QUANTUM COMPUTING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

**The Course will enable learners:**

- To know the background of classical computing and quantum computing.
- To learn the fundamental concepts behind quantum computation.
- To study the details of quantum mechanics and its relation to Computer Science.
- To gain knowledge about the basic hardware and mathematical models of quantum computation.
- To learn the basics of quantum information and the theory behind it.

| UNIT I | QUANTUM COMPUTING BASIC CONCEPTS | 9 |
|---|---|---|

Complex Numbers - Linear Algebra - Matrices and Operators - Global Perspectives Postulates of Quantum Mechanics – Quantum Bits - Representations of Qubits - Superpositions

| UNIT II | QUANTUM GATES AND CIRCUITS | 9 |
|---|---|---|

Universal logic gates - Basic single qubit gates - Multiple qubit gates - Circuit development - Quantum error correction

| UNIT III | QUANTUM ALGORITHMS | 9 |
|---|---|---|

Quantum parallelism - Deutsch's algorithm - The Deutsch–Jozsa algorithm - Quantum Fourier transform and its applications - Quantum Search Algorithms: Grover's Algorithm

| UNIT IV | QUANTUM INFORMATION THEORY | 9 |
|---|---|---|

Data compression - Shannon's noiseless channel coding theorem - Schumacher's quantum noiseless channel coding theorem - Classical information over noisy quantum channels

| UNIT V | QUANTUM CRYPTOGRAPHY | 9 |
|---|---|---|

Classical cryptography basic concepts - Private key cryptography - Shor's Factoring Algorithm - Quantum Key Distribution - BB84 - Ekart 91

**TOTAL= 45 PERIODS**

**COURSE OUTCOMES:**

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

**CO1:** Understand and apply foundational mathematical concepts to represent and analyze quantum bits (qubits) and superpositions.

**CO2:** Design and analyze quantum circuits using basic and multiple qubit gates

**CO3:** Apply principles of quantum information theory in classical and quantum communication contexts.

**CO4:** Analyze and compare classical and quantum cryptographic techniques

**CO5:** Implement and evaluate quantum algorithms

**CO6:** Develop simple quantum programs using quantum logic and algorithms

**TEXTBOOKS**


1. Parag K Lala, Mc Graw Hill Education, "Quantum Computing, A Beginners Introduction", First edition (1 November 2020).
2. Michael A. Nielsen, Issac L. Chuang, "Quantum Computation and Quantum Information", Tenth Edition, Cambridge University Press, 2010.
3. Chris Bernhardt, The MIT Press; Reprint edition (8 September 2020), "Quantum Computing for Everyone".


**REFERENCES:**


1. Scott Aaronson, "Quantum Computing Since Democritus", Cambridge University Press, 2013.
2. N. David Mermin, "Quantum Computer Science: An Introduction", Cambridge University Press, 2007.

**HONOURS DEGREE WITH SPECIALIZATION IN DATA SCIENCE**

| 24IT950 | NEURAL NETWORKS AND DEEP LEARNING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

**The Course will enable learners to:**

- Understand the basics of deep neural networks.
- Implement deep learning models.
- Elaborate CNN and RNN architectures of deep neural networks.
- Familiarize autoencoders in neural networks.
- Learn about the deep generative models.
- Apply Deep Learning to solve real-world problems.

| UNIT I | NEURAL NETWORKS | 9 |
|---|---|---|

Introduction – Data Representation -Tensor Operations – Gradient-based Optimization – Architecture – Keras – Shallow Neural Networks.

| UNIT II | DEEP NETWORKS | 9 |
|---|---|---|

Deep feedforward networks - Learning XOR - Gradient based learning - Hidden Units – Architecture Design – Back Propagation – Regularization – Parameter Norm Penalties – Constrained Optimization – Under-Constrained Problems – Dataset Augmentation – Noise Robustness – Semi-Supervised Learning – Multi-Task Learning – Early Stopping – Parameter
Tying and Sharing – Bagging and Other Ensemble methods – Dropout – Adversarial Training.

| UNIT III | CONVOLUTIONAL AND RECURRENT NEURAL NETWORKS | 9 |
|---|---|---|

Convolution Operation – Pooling – Infinitely Strong prior – Variants – Structured Output – Data Types – Efficient Convolutional Algorithms – Random or Unsupervised features – Neuroscientific Basis - Computational Graphs - RNN - Bidirectional RNN – Encoder-Decoder - Sequence to Sequence RNN - Deep Recurrent Networks - Recursive Neural Networks - Long Term Dependencies - Leaky Units - Strategies for multiple time scales – LSTM and Gated RNNs - Optimization for Long Term Dependencies.

| UNIT IV | AUTOENCODERS | 9 |
|---|---|---|

Autoencoders: Undercomplete autoencoders - Regularized autoencoders – Power, Layer Size and Depth - Stochastic encoders and decoders – Denoising Autoencoders - Learning with autoencoders – contractive Autoencoders – Applications of autoencoders.

| UNIT V | DEEP GENERATIVE MODELS | 9 |
|---|---|---|

Boltzmann Machine – Restricted Boltzmann Machine – Deep Belief Networks – Deep Boltzmann Machines - Boltzmann Machines for Real-Valued Data – Convolutional Boltzmann Machines - Boltzmann Machine for Structured or Sequential Outputs – Directed Generative Nets – Evaluating Generative Models.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

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

**CO1:** Demonstrate the basics of deep neural networks to solve real world problems.

**CO2:** Implement deep learning models.

**CO3:** Elaborate CNN and RNN architectures of deep neural networks.

**CO4:** Apply autoencoders in neural networks.

**CO5:** Compare the various deep generative models.

**CO6:** Apply deep generative models to solve real world problems.

**TEXTBOOKS:**


1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, MIT Press, 2016.
2. Francois Chollet, “Deep Learning with Python”, Manning Publications, 2018.


**REFERENCES:**


1. Simon J.D. Prince, “Understanding Deep Learning”, MIT Press, 2023.
2. Charu C. Aggarwal, “Neural Networks and Deep Learning: A Textbook”, Springer International Publishing, 2018.
3. Yoav Goldberg, “Neural Network Methods for Natural Language Processing”, Synthesis Lectures on Human Language Technologies, Morgan & Claypool publishers, 2017.
4. Francois Chollet, “Deep Learning with Python”, Manning Publications Co, 2018.
5. Josh Patterson, Adam Gibson, “Deep Learning: A Practitioner's Approach”, O'Reilly Media, 2017.
6. Navin Kumar Manaswi, “Deep Learning with Applications Using Python”, Apress, 2018.
7. Richard O. Duda, Peter E. Hart, David G. Stork, “Pattern Classification”, John Wiley & Sons Inc., 2007.

**HONOURS DEGREE WITH SPECIALIZATION IN CYBER SECURITY**

| 24IT955 | ENGINEERING SECURE SOFTWARE SYSTEMS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

**The Course will enable learners to:**

- Know the importance and need for software security.
- Know about various attacks.
- Learn about secure software design.
- Understand risk management in secure software development.
- Know the working of tools related to software security.

| UNIT I | NEED OF SOFTWARE SECURITY AND LOW-LEVEL ATTACKS | 9 |
|---|---|---|

Software Assurance and Software Security – Threats to software security – Sources of software insecurity – Benefits of Detecting Software Security – Properties of Secure Software – Memory Based Attacks: Low-Level Attacks Against Heap and Stack – Defense Against Memory-Based Attacks

| UNIT II | SECURE SOFTWARE DESIGN | 9 |
|---|---|---|

Requirements Engineering for secure software- SQUARE process Model- Tools- SQUARE Final Results- Requirement Elicitation and Prioritization- The Critical Role of Architecture and Design- Issues and Challenges - Software Characterization - Threat Analysis - Architectural Vulnerability Assessment.

| UNIT III | SECURITY RISK MANAGEMENT | 9 |
|---|---|---|

Risk Management Life Cycle – Risk Profiling – Risk Exposure Factors – Risk Evaluation and Mitigation – Risk Assessment Techniques – Threat and Vulnerability Management.

| UNIT IV | SECURITY TESTING | 9 |
|---|---|---|

Software Security Testing- Contrasting Software Testing and Software Security Testing- Functional Testing- Risk-Based Testing-Secure Software Development Life Cycle- Unit Testing, Testing Libraries and Executable Files, Integration Testing, System Testing.

| UNIT V | SECURE PROJECT MANAGEMENT | 9 |
|---|---|---|

Governance and security – Adopting an enterprise software security framework – Security and project management – Maturity of Practice-Case Study: Implement the SQL Injection attack and Buffer Overflow attack.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

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

**CO1:** Analyze low-level memory attacks and implement corresponding defenses.

**CO2:** Implement requirements engineering and architectural vulnerability assessment.

**CO3:** Evaluate and mitigate risks throughout the software development lifecycle.

**CO4:** Implement various testing techniques to ensure software security

**CO5:** Apply enterprise security frameworks in project governance.

**CO6:** Analyze case studies to understand real-world security threats in project management.

**TEXTBOOKS:**

1. Julia H. Allen, Software Security Engineering, Pearson Education, 2009.
2. Evan Wheeler, Security Risk Management: Building an Information Security Risk Management Program from the Ground Up, First edition, Syngress Publishing, 2011.

**REFERENCES:**

1. Rajib Mall," Fundamentals Of Software Engineering", 5th Edition, PHI Learning, 2018.
2. Jon Erickson,"Hacking: The Art of Exploitation",2nd Edition, No Starch Press, 2008.
3. Mike Shema,"Hacking Web Apps: Detecting and Preventing Web Application Security Problems", First Edition, Syngress Publishing,2012.
4. Bryan Sullivan and Vincent Liu,"Web Application Security, A Beginner's Guide",Kindle Edition, McGraw Hill,2012.
5. Lee Allen,"Advanced Penetration Testing for Highly-Secured Environments: The Ultimate Security Guide (Open Source: Community Experience Distilled)", Kindle Edition, Packt Publishing,2012.
6. Chris Wysopal, Lucas Nelson, Dino Dai Zovi, and Elfriede Dustin, "The Art of Software Security Testing: Identifying Software Security Flaws (Symantec Press)", Addison- Wesley Professional, 2006.

**HONOURS DEGREE WITH SPECIALIZATION IN FULL STACK ENGINEERING**

| 24IT960 | FRONT END ENGINEERING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES:**

**The Course will enable the learners:**

- To understand web semantics and framework
- To interpret the functionality of Angular frameworks
- To develop a scalable and responsive web application
- To integrate database and perform CRUD operations

| UNIT I | ADVANCED WEB TECHNOLOGY | 9 |
|---|---|---|

An Introduction to HTML5 – Tags, Link, Images, Forms, Label, Sections, Media, Structure,CSS3 – inline, internal, Box Model, Targeting Elements, Flex Model, Responsive andFluid Layout, Media Queries-- An introduction to JavaScript (ES9) – Data Types – Conditionals and Loops – Functions – Classes and Objects – Inbuilt Methods – Arrays – Regular Expressions – Arrow Functions – Debugging in browsers – JS HTML DOM – JS Browser BOM – Introduction to AJAX and JSON – JS vs JQuery – Why JS Frameworks – Scope and Function Context - Closures - JavaScript Design Pattern.

| UNIT II | JAVASCRIPT MVW FRAMEWORK | 9 |
|---|---|---|

TypeScript – Static Typing, User Defined Data Types, Lambda Expression and Functional Programming, String, Number, Boolean, Union, Tuple, Object Oriented Programming – Inheritance, Interface, Access Modifiers, Let vs Var, Arrays, Generics, Duck Typing,Any/Unknown, TS Config. Narrowing, Decorators, Generics, Enum, Conditional Types, Unit Testing (JEST)

| UNIT III | INTRODUCTION TO ANGULAR | 9 |
|---|---|---|

Introduction to Single Page Application (SPA) and Angular Architecture, SPA's Components and Templates, Interpolation and 2-way data binding, Modules, Reactive Forms & Validations), Promise and Observable, CLI Features, i18n, Workspace Structure, Micro Front End, Scalable UI rxjs operators (map/filter/takeuntil), Loading of Modules, Pagination, Web Artifacts optimization, Standalone Components

| UNIT IV | TESTING ANGULAR APPLICATIONS | 9 |
|---|---|---|

Service Definition and Injection, Routes and Navigation, Data Integrity enablement, Flux/Redux, Security, Pipes and Directives, Behavior Subject, Logging and Exceptions handling, Performance Engineering, Unit Testing using JEST, Responsive Web design using Bootstrap and Material Design Angular Deployments – nginx, proxy setup, load balancer, SSL configuration

| UNIT V | MEAN STACK | 9 |
|---|---|---|

NodeJS Introduction and Installation, YARN Integration, Imports and Modules, ExpressJS, JWT/OAUTH2.0 based security, Routes and Middleware, NoSQL DB Integration – Config – Reactive DB Operations – CRUD, Exception Handling, Transaction Management, Logging and Audit, Deployment

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES**:

After completing the course, students will have the ability to

**CO1:** Design a web page using text formatting, graphics, audio, and video.

**CO2:** Apply TypeScript features and principles of functional and object-oriented programming to build

and test robust, type-safe applications.

**CO3:** Develop scalable Single Page Applications using Angular with efficient component architecture, reactive forms, and optimized web artifacts.

**CO4:** Develop and deploy responsive Angular applications with unit testing and production-ready configurations using Bootstrap, Material Design.

**CO5:** Build a web application integrating Databases

**CO6:** Develop data driven back end API using NodeJS as the core platforms.

**TEXTBOOKS:**


1. John & Michael Kocer" Angular 11 by Example 2021", Kindle Edition, 2020.
2. Lars Gyrup Brink Nielsen, "Accelerating Angular Development with Ivy", Paperback Edition, 2021.


**REFERENCES:**


1. Doguhan Uluca, "Angular 6 for Enterprise-Ready Web Applications: Deliver production-ready and cloud-scale Angular web apps", 1st Edition, Kindle Edition, 2018.
2. Adam Freeman, "Pro AngularJS (Expert's Voice in Web Development) Paperback", 2014.
3. Nate Murray, Felipe Coury, Ari Lerner, Carlos Taborda, "ng-book: The Complete Guide to Angular", 2018.

**HONOURS DEGREE WITH SPECIALIZATION IN MEDIA PROCESSING**

| 24IT965 | DESIGN PROGRAMMING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

**The Course will enable learners to:**

- Provide an idea about Blender interface
- Impart a good understanding of materials and textures.
- Gain clear knowledge on Nurbs and meta shapes.
- Attain insight on Unity Scripts.
- Understand decision making in games.

| UNIT I | BLENDER INTERFACE AND NAVIGATION | 9 |
|---|---|---|

3D Modeling-The blender Screen- The user preferences window-preset Interface arrangements- The 3D window-Window Modes-Layers-Moving in 3D space-Blender View menu, Controls, windows-Navigation- Creating and editing Objects

| UNIT II | MATERIALS AND TEXTURES | 9 |
|---|---|---|

Material settings -Material Buttons, Colors- Textures-Texture Mapping-Unwrapping with Seams-Texture Paint-World Settings-Lighting and Cameras-Rendering and Ray Tracing

| UNIT III | NURBS AND META SHAPES | 9 |
|---|---|---|

Introduction to 3D Text-Creating 3D Text in Blender-Converting Text to Mesh Object- Converting text to a curve-Modifiers-Modifiers for generating, deforming, Simulating.

| UNIT IV | UNITY SCRIPTS | 9 |
|---|---|---|

Basic C# scripting- Introducing scripting in unity- Method instead of function - Introducing

Classes -Passing values between the classes - Using objects and classes in game script- Understanding component property in scripts - Displaying public variables in inspector panel - Multi-word variable names- Common – built – in variable types - Variable scopes.

| UNIT V | DECISION MAKING IN GAMES | 9 |
|---|---|---|

Condition testing using if statement - Usage of for each loop -Usage of while loop - Storing game objects in array -Storing game objects in list- Using dot syntax in unity script - Accessing components own variables and methods - Accessing another game objects and its components.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

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

**CO1:** Understand Blender interface

**CO2:** Understand Texture Mapping and Rendering

**CO3:** Analyze Text to Mesh Object and Curve conversion

**CO4:** Implement the scripting fundamentals

**CO5:** Understand accessing game objects

**CO6:** Develop and animate a game character

**TEXTBOOKS:**


1. John M.Blain ,"Complete guide to blender graphics",4th edition, Taylor & Francis publications, 2020.
2. Terry Norton, "Learning C# by Developing Games with Unity 3D Beginner's Guide", second edition, Packt Publishing Limited, 2013.


**REFERENCES:**


1. Lee ZhiEng, "Building a Game with Unity and Blender",1st Edition , Packt Publishing Limited , 2015.
2. Michelle Menard, "Game development with unity", 2nd edition, Cengage Learning PTR, 2015.
3. VahéKaramian," Introduction to Game Programming: Using C# and Unity 3D", Noorcon Inc.2016
4. Michelle Menard, Bryan Wagstaff,"Game development with Unity", Cengage Learning, 2015.


**SOFTWARE REQUIREMENTS:**

1. Unity
2. Blender

**HONOURS DEGREE WITH SPECIALIZATION IN FINTECH AND WEB 3.0**

| 24IT970 | FUNDAMENTALS OF BLOCKCHAIN | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES:**

**The Course will enable the learners to:**

- The students should be able to understand a broad overview of the essential concepts of blockchain technology.
- To familiarize students with Bitcoin protocol followed by the Ethereum protocol – to lay the foundation necessary for developing applications and programming.
- Students should be able to learn about different types of blockchain and consensus algorithms.

| UNIT I | INTRODUCTION | 9 |
|---|---|---|

The Double-Spend Problem, Byzantine Generals' Computing Problems, Public Key Cryptography, Hashing, Distributed Systems, Distributed Consensus.

| UNIT II | BITCOIN BLOCKCHAIN | 9 |
|---|---|---|

Structure, Operations, Features, Consensus Model, Incentive Model.

| UNIT III | ETHEREUM BLOCKCHAIN | 9 |
|---|---|---|

Smart Contracts, Ethereum Structure, Operations, Consensus Model, Incentive Model.

| UNIT IV | TIERS OF BLOCKCHAIN TECHNOLOGY | 9 |
|---|---|---|

Blockchain 1.0, Blockchain 2.0, Blockchain 3.0, Types of Blockchain: Public Blockchain, Private Blockchain, Semi-Private Blockchain, Sidechains.

| UNIT V | TYPES OF CONSENSUS ALGORITHMS | 9 |
|---|---|---|

Proof of Stake, Proof of Work, Delegated Proof of Stake, Proof Elapsed Time, Deposited-Based Consensus, Proof of Importance, Federated Consensus or Federated Byzantine Consensus, Practical Byzantine Fault Tolerance. Blockchain

Use Case: Supply Chain Management.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

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

**CO1:** Evaluate the fundamental principles and architecture of distributed systems.

**CO2:** Analyze the operation and security implications of an immutable distributed ledger and the trust model underpinning blockchain technology.

**CO3:** Design and construct blockchain platforms by integrating and optimizing their essential components.

**CO4:** Assess the performance and scalability of various blockchain platforms through detailed case studies and simulations.

**CO5:** Develop innovative solutions to enhance the functionality and security of blockchain systems.

**CO6:** Formulate and justify strategies for the deployment and management of blockchain technology in real-world applications.

**TEXTBOOKS:**


1. Kiran kalyan Kulkarni, Essentials of Bitcoin and Blockchain, Packt Publishing.
2. Tiana Laurence, Blockchain for Dummies, 2nd Edition 2019, John Wiley & Sons.
3. Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks by Imran Bashir, Packt Publishing (2017)


**REFERENCES:**


1. Blockchain: Blueprint for a New Economy by Melanie Swan, Shroff Publisher O'Reilly Publisher Media; 1st Edition (2015)
2. Mastering Bitcoin: Programming the Open Blockchain by Andreas Antonopoulos

**HONOURS DEGREE WITH SPECIALIZATION IN ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING**

| 24IT975 | FOUNDATIONS OF DEEP LEARNING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

- To outline the basics of deep neural networks.
- To discuss advanced deep learning models.
- To discuss CNN and RNN architectures of deep neural networks.
- To elaborate autoencoders in neural networks.
- To discuss the deep generative models.

| UNIT I | DEEP NETWORKS | 9 |
|---|---|---|

Challenges motivating deep learning - Deep feedforward networks - Learning XOR - Gradient based learning - Hidden Units – Architecture Design – Back Propagation – Regularization – Parameter Norm Penalties – Constrained Optimization – Under-Constrained Problems – Dataset Augmentation – Noise Robustness – Semi-Supervised Learning – Multi-Task Learning – Early Stopping – Parameter Tying and Sharing – Bagging and Other Ensemble methods – Dropout – Adversarial Training.

| UNIT II | OPTIMIZATION FOR TRAINING DEEP MODELS | 9 |
|---|---|---|

Pure optimization – Challenges – Basic Algorithms – Parameter initialization Strategies – Algorithms with Adaptive Learning Rates – Approximate Second-Order methods – Optimization Strategies and Meta Algorithms.

| UNIT III | CONVOLUTIONAL AND RECURRENT NEURAL NETWORKS | 9 |
|---|---|---|

Convolution Operation – motivation – Pooling – Infinitely Strong prior – Variants – Structured Output – Data Types – Efficient Convolutional Algorithms – Random or Unsupervised features – Neuroscientific Basis - Deep Learning – Sequence Modelling - Computational Graphs - RNN - Bidirectional RNN – Encoder-Decoder - Sequence to Sequence RNN - Deep Recurrent Networks - Recursive Neural Networks - - Long Term Dependencies; Leaky Units – Strategies for multiple time scales – LSTM and Gated RNNs – Optimization for Long Term Dependencies.

| UNIT IV | AUTOENCODERS | 9 |
|---|---|---|

Autoencoders: Undercomplete autoencoders - Regularized autoencoders – Power, Layer Size and Depth - Stochastic encoders and decoders – Denoising Autoencoders - Learning with autoencoders – contractive Autoencoders – Applications of autoencoders.

| UNIT V | DEEP GENERATIVE MODELS | 9 |
|---|---|---|

Boltzmann Machine – Restricted Boltzmann Machine – Deep Belief Networks – Deep Boltzmann Machines - Boltzmann Machines for Real-Valued Data – Convolutional Boltzmann Machines - Boltzmann Machine for Structured or Sequential Outputs – Directed Generative Nets – Evaluating Generative Models.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

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

**CO1**: Understand the basics of deep neural networks.

**CO2**: Develop advanced deep learning models.

**CO3**: Implement CNN and RNN architectures of deep neural networks.

**CO4**: Interpret autoencoders in neural networks.

**CO5**: Apply deep generative models to solve real world problems.

**CO6**: Build deep learning models and evaluate them.

**TEXTBOOKS:**

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, “Deep Learning", MIT Press, 2016.

**REFERENCES:**

1. Charu C. Aggarwal, ``Neural Networks and Deep Learning: A Textbook", Springer International Publishing, 2018.
2. Yoav Goldberg, ``Neural Network Methods for Natural Language Processing", Synthesis Lectures on Human Language Technologies, Morgan & Claypool publishers, 2017.
3. Francois Chollet, ``Deep Learning with Python", Manning Publications Co, 2018.
4. Josh Patterson, Adam Gibson, ``Deep Learning: A Practitioner's Approach", O'Reilly Media, 2017.
5. Navin Kumar Manaswi, “Deep Learning with Applications Using Python”, Apress, 2018.

**NPTEL:**

6. Deep Learning - https://onlinecourses.nptel.ac.in/noc24_ee04/preview
7. Deep Learning - IIT Ropar - https://onlinecourses.nptel.ac.in/noc24_cs59/preview

## HONOURS DEGREE WITH SPECIALIZATION IN QUANTUM COMPUTING

| 24IT980 | QUANTUM COMPUTING FOUNDATIONS | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**OBJECTIVES:**

**The Course will enable learners to:**

- Understand the fundamentals of quantum mechanics
- Familiarize the concepts of Linear Algebra
- Perform Quantum computation
- Apply Quantum Algorithms for real time applications
- Comprehend the challenges in Quantum Technology

| UNIT I | OVERVIEW OF QUANTUM COMPUTING | 9 |
|---|---|---|

Basic quantum mechanics, Classical vs Quantum systems, Quantum supremacy, Quantum computer architectures, Quantum applications, Introduction to Quantum theory: Complex Numbers, Linear Algebra – vector and matrix operations

| UNIT II | QUANTUM STATES AND QUANTUM GATES | 9 |
|---|---|---|

Dirac notation, Bloch sphere, Hilbert space, Quantum superposition, Single qubit gates, multiple qubit gates, Quantum entanglement, Bell state

| UNIT III | QUANTUM SOFTWARE DEVELOPMENT | 9 |
|---|---|---|

Quantum assembly language, Quantum programming languages, Quantum simulator, Design and evaluation of quantum algorithms, Complexities in real quantum system execution

| UNIT IV | QUANTUM ALGORITHMS | 9 |
|---|---|---|

Shor's Factorization algorithm, Grover's unstructured search algorithm, Simon's algorithm, Quantum error correcting code

| UNIT V | CHALLENGES IN QUANTUM TECHNOLOGY | 9 |
|---|---|---|

Quantum measurement, Cloning theorem, Scalability in real quantum systems, Quantum Applications: Healthcare, transportation, finance, security, Quantum warfare, cryptography

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

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

**CO 1:** Understand quantum mechanics concepts
**CO 2:** Apply linear algebra operations
**CO 3:** Interpret quantum computer systems
**CO 4:** Analyze quantum application software
**CO 5:** Implement quantum technology in secure computing
**CO 6:** Design and evaluate quantum programs for simple known algorithms

**TEXTBOOKS:**


1. Phillip Kaye, Raymond Laflamme et. al., An introduction to Quantum Computing, Oxford University press, 2007.
2. Chris Bernhardt, Quantum Computing for Everyone, The MIT Press, Cambridge, 2020
3. David McMahon-Quantum Computing Explained-Wiley-Interscience ,IEEE Computer Society (2008)


**REFERENCES:**


1. Quantum Computation and Quantum Information, M. A. Nielsen & I.Chuang, Cambridge University Press (2013).
2. Quantum Computing, A Gentle Introduction, Eleanor G. Rieffel and Wolfgang H. Polak MIT press (2014)

**MINOR DEGREE WITH SPECIALIZATION IN FULL STACK ENGINEERING**

| 24IT985 | FRONT END ENGINEERING | L | T | P | C |
|---|---|---|---|---|---|
| | | 3 | 0 | 0 | 3 |

**COURSE OBJECTIVES:**

**The Course will enable the learners:**

- To understand web semantics and framework
- To interpret the functionality of Angular frameworks
- To develop a scalable and responsive web application
- To integrate database and perform CRUD operations

| UNIT I | ADVANCED WEB TECHNOLOGY | 9 |
|---|---|---|

An Introduction to HTML5 – Tags, Link, Images, Forms, Label, Sections, Media, Structure,CSS3 – inline, internal, Box Model, Targeting Elements, Flex Model, Responsive andFluid Layout, Media Queries-- An introduction to JavaScript (ES9) – Data Types – Conditionals and Loops – Functions – Classes and Objects – Inbuilt Methods – Arrays – Regular Expressions – Arrow Functions – Debugging in browsers – JS HTML DOM – JS Browser BOM – Introduction to AJAX and JSON – JS vs JQuery – Why JS Frameworks – Scope and Function Context - Closures - JavaScript Design Pattern.

| UNIT II | JAVASCRIPT MVW FRAMEWORK | 9 |
|---|---|---|

TypeScript – Static Typing, User Defined Data Types, Lambda Expression and Functional Programming, String, Number, Boolean, Union, Tuple, Object Oriented Programming – Inheritance, Interface, Access Modifiers, Let vs Var, Arrays, Generics, Duck Typing,Any/Unknown, TS Config. Narrowing, Decorators, Generics, Enum, Conditional Types, Unit Testing (JEST)

| UNIT III | INTRODUCTION TO ANGULAR | 9 |
|---|---|---|

Introduction to Single Page Application (SPA) and Angular Architecture, SPA's Components and Templates, Interpolation and 2-way data binding, Modules, Reactive Forms & Validations), Promise and Observable, CLI Features, i18n, Workspace Structure, Micro Front End, Scalable UI rxjs operators (map/filter/takeuntil), Loading of Modules, Pagination, Web Artifacts optimization, Standalone Components

| UNIT IV | TESTING ANGULAR APPLICATIONS | 9 |
|---|---|---|

Service Definition and Injection, Routes and Navigation, Data Integrity enablement, Flux/Redux, Security, Pipes and Directives, Behavior Subject, Logging and Exceptions handling, Performance Engineering, Unit Testing using JEST, Responsive Web design using Bootstrap and Material Design Angular Deployments – nginx, proxy setup, load balancer, SSL configuration

| UNIT V | MEAN STACK | 9 |
|---|---|---|

NodeJS Introduction and Installation, YARN Integration, Imports and Modules, ExpressJS, JWT/OAUTH2.0 based security, Routes and Middleware, NoSQL DB Integration – Config – Reactive DB Operations – CRUD, Exception Handling, Transaction Management, Logging and Audit, Deployment

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES**:

After completing the course, students will have the ability to

**CO1:** Design a web page using text formatting, graphics, audio, and video.

**CO2:** Apply TypeScript features and principles of functional and object-oriented programming to build and test robust, type-safe applications.

**CO3:** Develop scalable Single Page Applications using Angular with efficient component architecture, reactive forms, and optimized web artifacts.

**CO4:** Develop and deploy responsive Angular applications with unit testing and production-ready configurations using Bootstrap, Material Design.

**CO5:** Build a web application integrating Databases

**CO6:** Develop data driven back end API using NodeJS as the core platforms.

**TEXTBOOKS:**


1. John & Michael Kocer" Angular 11 by Example 2021", Kindle Edition, 2020.
2. Lars Gyrup Brink Nielsen, "Accelerating Angular Development with Ivy", Paperback Edition, 2021.


**REFERENCES:**


1. Doguhan Uluca, "Angular 6 for Enterprise-Ready Web Applications: Deliver production-ready and cloud-scale Angular web apps", 1st Edition, Kindle Edition, 2018.
2. Adam Freeman, "Pro AngularJS (Expert's Voice in Web Development) Paperback", 2014.
3. Nate Murray, Felipe Coury, Ari Lerner, Carlos Taborda, "ng-book: The Complete Guide to Angular", 2018.

| 24IT990 | FOUNDATIONS OF ENTREPRENERUSHIP | L | T | P | C |
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**COURSE OBJECTIVES:**

**The Course will enable the learners:**

- To develop and strengthen the entrepreneurial quality and motivation of learners.
- To impart the entrepreneurial skills and traits essential to become successful entrepreneurs.
- To apply the principles and theories of entrepreneurship and management in Technology oriented businesses.
- To empower the learners to run a Technology driven business efficiently and effectively

| UNIT I | INTRODUCTION TO ENTREPRENEURSHIP | 9 |
|---|---|---|

Entrepreneurship- Definition, Need, Scope - Entrepreneurial Skill & Traits - Entrepreneur vs. Intrapreneur- Classification of entrepreneurs, Types of entrepreneurs -Factors affecting entrepreneurial development – Achievement Motivation – Contributions of Entrepreneurship to Economic Development.

| UNIT II | BUSINESS OWNERSHIP & ENVIRONMENT | 9 |
|---|---|---|

Types of Business Ownership – Business Environmental Factors – Political- Economic-Sociological-Technological-Environmental-Legal aspects – Human Resources Mobilization-Basics of Managing Finance- Essentials of Marketing Management - Production and Operations Planning – Systems Management and Administration

| UNIT III | FUNDAMENTALS OF TECHNOPRENEURSHIP | 9 |
|---|---|---|

Introduction to Technopreneurship - Definition, Need, Scope- Emerging Concepts-
Principles - Characteristics of a technopreneur - Impacts of Technopreneurship on Society – Economy- Job Opportunities in Technopreneurship - Recent trends

| UNIT IV | APPLICATIONS OF TECHNOPRENEURSHIP | 9 |
|---|---|---|

Technology Entrepreneurship - Local, National and Global practices - Intrapreneurship and Technology interactions, Networking of entrepreneurial activities – Launching – Managing
Technology based Product / Service entrepreneurship -– Success Stories of Technopreneurs - Case Studies

| UNIT V | EMERGING TRENDS IN ENTREPRENERUSHIP | 9 |
|---|---|---|

Effective Business Management Strategies For Franchising - Sub- Contracting- Leasing- Technopreneurs – Agripreneurs - Netpreneurs- Portfolio entrepreneurship - NGO Entrepreneurship – Recent Entrepreneurial Developments - Local – National – Global perspectives.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

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

**CO1:** Understand the basics of Entrepreneurship

**CO2:** Analyze business ownership patterns and environment

**CO3:** Analyze various Job opportunities relating to Technopreneurship

**CO4:** Learn about applications of technopreneurship and successful technopreneurs

**CO5:** Acquaint with the recent and emerging trends in entrepreneurship

**TEXTBOOKS:**


1. S.S.Khanka, "Entrepreneurial Development" S.Chand & Co. Ltd. Ram Nagar New Delhi, 2021.
2. Donal F Kuratko Entrepreneurship (11th Edition) Theory, Process, Practice by Published 2019 by Cengage Learning,


**REFERENCES:**


1. Daniel Mankani. 2003. Technopreneurship: The successful Entrepreneur in the new Economy. Prentice Hall
2. Edward Elgar. 2007. Entrepreneurship, Cooperation and the Firm: The Emergence and Survival of High-Technology Ventures in Europe. Edi: Jan Ulijn, Dominique Drillon, and Frank Lasch. Wiley Pub.
3. Lang, J. 2002, The High Tech Entrepreneur's Handbook, Ft.com.
4. David Sheff 2002, China Dawn: The Story of a Technology and Business Revolution,
5. JumpStart: A Technoprenuership Fable, Dennis Posadas, (Singapore: Pearson Prentice Hall, 2009
6. Basics of Technoprenuership: Module 1.1-1.2, Frederico Gonzales, President-PESO Inc; M. Barcelon, UP


**E-RESOURCES:**

1. Harper Business, https://fanny.staff.uns.ac.id/files/2013/12/Technopreneur- Based- Education-Revolution.pdf