Mahatma Education Society's

# Pillai College of Engineering

## *(Autonomous)*

## Affiliated to University of Mumbai

Dr. K. M. Vasudevan Pillai's Campus , Sector 16, New Panvel – 410 206.

## Department of Electronics & Computer Science

**Syllabus**

*of*

## B.Tech. in Electronics & Computer Science

*for*

**The Admission Batch of AY 2023-24**

**First Year -** Effective from Academic Year **2023-24**

**Second Year -** Effective from Academic Year **2024-25**

**Third Year -** Effective from Academic Year **2025-26**

**Fourth Year -** Effective from Academic Year **2026-27**

*as per Choice Based Credit and Grading System*

Adm 2023-24

Mahatma Education Society's

# Pillai College of Engineering

## Vision

Pillai College of Engineering (PCE) will admit, educate and train a diverse population of students who are academically prepared to benefit from the Institute's infrastructure and faculty experience, to become responsible professionals or entrepreneurs in a technical arena. It will further attract, develop and retain, dedicated, excellent teachers, scholars and professionals from diverse backgrounds whose work gives them knowledge beyond the classroom and who are committed to making a significant difference in the lives of their students and the community.

## Mission

To develop professional engineers with respect for the environment and make them responsible citizens in technological development both from an Indian and global perspective. This objective is fulfilled through quality education, practical training and interaction with industries and social organizations.

Y23-24

Dr. K. M. Vasudevan Pillai's Campus , Sector - 16, New Panvel – 410 206

# Department of Electronics & Computer Science

## Vision

To produce professionally competent and socially responsible engineers capable of working globally.

## Mission

To provide in-depth quality education in Electronics & Computer Science Engineering and prepare the students for lifelong learning.

To develop professional engineers who can critically and creatively apply the knowledge of engineering principles to solve real world problems.

To inculcate entrepreneurship skills and impart ethical and social values.

## Program Educational Objectives (PEOs):

I. Graduates will have the ability to apply engineering knowledge and skills to provide solutions to real world technical problems.
II. Graduates will be successful as engineering professionals, innovators or entrepreneurs with a multidisciplinary approach contributing towards research and technological developments.
III. Graduates will have the ability to pursue higher education in Electronics Engineering, Computer Science and allied streams.
IV. Graduates will function in their profession with social awareness and responsibility while maintaining ethical standards.

## Program Outcomes:

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

Adm Y 23-24

appropriate consideration for 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 of 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 the 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 teamwork: 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 work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. Life-long learning: Recognized 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 Outcomes (PSOs):

Engineering Graduates will be able to

1. Gain knowledge and skills to analyse and design Electronics circuits as well as Computer Programs.
2. Develop hardware and software systems in the areas like Artificial Intelligence & Machine learning, Big Data, Information Security, Automation, Embedded Systems, Signal Processing and Communication Systems.
3. Apply modern Electronics and Computer engineering techniques and tools to find solutions for real life interdisciplinary problems.

Adm Y23-24

The Autonomous status of the institute has given an opportunity to design and frame the curriculum in such a way that it incorporates all the needs and requirements of recent developments in all fields within the scope of the Technical education. This curriculum will help graduates to attain excellence in their respective field. The curriculum has a blend of basic and advanced courses along with provision of imparting practical knowledge to students through minor and major projects. The syllabus has been approved and passed by the Board of Studies.

Outcome based education is implemented in the academics and every necessary step is undertaken to attain the requirements. Every course has its objectives and outcomes defined in the syllabus which are met through continuous assessment and end semester examinations. Evaluation is done on the basis of Choice Based Credit and Grading System (CBCGS). Optional courses are offered at department and institute level. Selection of electives from the same specialization makes the student eligible to attain a B. Tech. degree with respective specialization.

Every learner/student will be assessed for each course through (i) an Internal/Continuous assessment during the semester in the form of either Practical Performance, Presentation, Demonstration or written examination and (ii) End Semester Examination (ESE), in the form of either theory or viva voce or practical, as prescribed by the respective Board Studies and mentioned in the assessment scheme of the course content/syllabus. This system involves the Continuous Evaluation of students' progress Semester wise. The number of credits assigned with a course is based on the number of contact hours of instruction per week for the course. The credit allocation is available in the syllabus scheme of each semester.

The performance of a learner in a semester is indicated by a number called Semester Grade Performance Index (SGPI). The SGPI is the weighted average of the grade points obtained in all the courses by the learner during the semester. For example, if a learner passes five courses (Theory/labs./Projects/ Seminar etc.) in a semester with credits C1, C2, C3, C4 and C5 and learners grade points in these courses are G1, G2, G3, G4 and G5 respectively, then learners SGPI is equal to:

$$SGPI = \frac{C_1G_1 + C_2G_2 + C_3G_3 + C_4G_4 + C_5G_5}{C_1 + C_2 + C_3 + C_4 + C_5}$$

The learner's up to date assessment of the overall performance from the time s/he entered for the programme is obtained by calculating a number called the Cumulative Grade Performance Index (CGPI), in a manner similar to the calculation of SGPI. The CGPI therefore considers all the courses mentioned in the scheme of instructions and examinations, towards the minimum requirement of the degree learners have enrolled for. The CGPI at the end of this semester is calculated as,

$$CGPI = \frac{C_1G_1 + C_2G_2 + C_3G_3 + \ldots + C_i * G_i + \ldots + C_nG_n}{C_1 + C_2 + C_3 + \cdots + C_i + \ldots + C_n}$$

The Department of Electronics & Computer Science offers a B. Tech. programme in Electronics & Computer Science. This is an eight semester course. The complete course is a 163 credit course which comprises core courses and elective courses. The elective courses are distributed over 8 specializations. The specializations are:

1. AIML
2. Robotics
3. Data Analytics
4. System Security
5. High Performance Computing
6. Cloud Computing
7. VLSI Design
8. IOT

The students also have a choice of opting for Institute level specializations. These are

1. Entrepreneurship Development and Management
2. Business Management
3. Intellectual Property Management
4. Bioengineering
5. Bio Instrumentation
6. Engineering Design
7. Sustainable Technologies
8. Contemporary Studies
9. Art and Journalism
10. Applied Science
11. Green Technologies
12. Maintenance Engineering
13. Life Skills
14. Environment & Safety
15. Quantum Computing and Quantum Technologies

**As minimum requirements for the credits to be earned during the B.Tech in Electronics & Computer Science program, a student will have to complete a minimum of three specializations of which two are to be chosen from the department list and one has to be from the Institute level specialization list. In order to complete each specialization, a minimum of three courses under that specialization has to be completed.**

Adm Y 23-24

# Semester I

| Course Code | Course Name | Category | Course Component | Teaching Scheme (Contact Hours) | | Credits Assigned | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | Pract/ Tuts | Theory | Pract /Tuts | Total |
| FY 101 | Engineering Mathematics I | BSC | TLP | 3 | 2 | 3 | 1 | 4 |
| FY 102 | Engineering Physics I | BSC | TL | 2 | 1 | 2 | 0.5 | 2.5 |
| FY 103 | Engineering Chemistry I | BSC | TL | 2 | 1 | 2 | 0.5 | 2.5 |
| FY 104 | C Programming | ESC | T | 3 | - | 3 | - | 3 |
| FY 105 | Basic Electrical Engineering | ESC | TL | 3 | 2 | 3 | 1 | 4 |
| FY 108 | C Programming Lab | Skill | LP | - | 2 | - | 1 | 1 |
| FY 111 | Basic Workshop I | Skill | LP | - | 2 | - | 1 | 1 |
| FY 113 | Indian Knowledge System | HSSM | T | - | 2+2# | - | 2 | 2 |
| FY 114 | Co-curricular Course I | Liberal Learning | L | - | 4 | - | 2 | 2 |
| **Total** | | | | **13** | **18** | **13** | **9** | **22** |

| Course Code | Course Name | Category | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Theory | | | | | Term Work | Pract /Oral | Total |
| | | | Internal Assessment | | | End Sem Exam | Exam Duration (Hrs) | | | |
| | | | 1 | 2 | Avg | | | | | |
| FY 101 | Engineering Mathematics I | BSC | 40 | 40 | 40 | 60 | 2 | 25 | - | 125 |
| FY 102 | Engineering Physics I | BSC | 30 | 30 | 30 | 45 | 2 | 25 | - | 100 |
| FY 103 | Engineering Chemistry I | BSC | 30 | 30 | 30 | 45 | 2 | 25 | - | 100 |
| FY 104 | C Programming | ESC | 40 | 40 | 40 | 60 | 2 | - | - | 100 |
| FY 105 | Basic Electrical Engineering | ESC | 40 | 40 | 40 | 60 | 2 | 25 | 25 | 150 |
| FY 108 | C Programming Lab | Skill | - | - | - | - | - | 25 | 25 | 50 |
| FY 111 | Basic Workshop I | Skill | - | - | - | - | - | 50 | - | 50 |
| FY 113 | *Indian Knowledge System* | HSSM | - | - | - | - | - | 50 | - | 50 |
| FY 114 | Co-curricular Course I | Liberal Learning | - | - | - | - | - | 50 | - | 50 |
| **Total** | | | | | | | | | | **775** |

**T- Theory , L- Lab , P-Programming, C- Communication**

Aqm Y23-24

# Semester II

| Course Code | Course Name | Category | Course Component | Teaching Scheme (Contact Hours) | | Credits Assigned | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | Pract/ Tuts | Theory | Pract /Tuts | Total |
| FY 107 | Engineering Mechanics and Graphics | ESC | TL | 3 | 2 | 3 | 1 | 4 |
| FY 115 | Engineering Mathematics II | BSC | TLP | 3 | 2 | 3 | 1 | 4 |
| FY 116 | Engineering Physics II | BSC | TL | 2 | 1 | 2 | 0.5 | 2.5 |
| FY 117 | Engineering Chemistry II | BSC | TL | 2 | 1 | 2 | 0.5 | 2.5 |
| FY 119 | Python Programming | Program Courses | TLP | 3 | - | 3 | - | 3 |
| FY 121 | Professional Communication & Ethics I | HSSM | TL | 1 | 2 | 1 | 1 | 2 |
| FY 122 | Python Programming lab | Skill | LP | - | 2 | - | 1 | 1 |
| FY 123 | Basic Workshop II | Skill | LP | - | 2 | - | 1 | 1 |
| FY 125 | Co-curricular Course II | *Liberal Learning* | | - | 4 | - | 2 | 2 |
| **Total** | | | | **14** | **16** | **14** | **8** | **22** |

| Course Code | Course Name | Category | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Theory | | | | | Term Work | Pract/ Oral | Total |
| | | | Internal Assessment | | | End Sem Exam | Exam Duration (Hrs) | | | |
| | | | 1 | 2 | Avg | | | | | |
| FY 107 | Engineering Mechanics and Graphics | ESC | 40 | 40 | 40 | 60 | 3 | 25 | 25 | 150 |
| FY 115 | Engineering Mathematics II | BSC | 40 | 40 | 40 | 60 | 2 | 25 | - | 125 |
| FY 116 | Engineering Physics II | BSC | 30 | 30 | 30 | 45 | 2 | 25 | - | 100 |
| FY 117 | Engineering Chemistry II | BSC | 30 | 30 | 30 | 45 | 2 | 25 | - | 100 |
| FY 119 | Python Programming | Program Courses | 40 | 40 | 40 | 60 | 2 | - | - | 100 |
| FY 121 | Professional Communication & Ethics I | HSSM | **20** | **20** | 20 | 30 | 1 | 25 | - | 75 |
| FY 122 | Python Programming lab | Skill | - | - | - | - | - | 25 | 25 | 50 |
| FY 123 | Basic Workshop II | Skill | - | - | - | - | - | 50 | - | 50 |
| FY 125 | Co-curricular Course II | *Liberal Learning* | - | - | - | - | - | 50 | - | 50 |
| **Total** | | | | | | | | | | **800** |

Aqm Y 23-24

## Semester III

| Course Code | Course Name | Category | Course Component | Teaching Scheme (Contact Hours) | | Credits Assigned | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | Pract /Tuts | Theory | Pract /Tuts | Total |
| EC 201 | Engineering Mathematics III | ESC | T | 3 | - | 3 | - | 3 |
| EC 202 | Analog Electronics Circuits | PCC | TL | 3 | - | 3 | | 3 |
| EC 203 | Digital Circuits & System Design | PCC | TL | 3 | - | 3 | - | 3 |
| EC 204 | Data Structures & Algorithms | MDM | TL | 3 | 2 | 3 | 1 | 4 |
| EC 205 | Database Management System | PCC | TLP | 3 | 2 | 3 | 1 | 4 |
| EC 206 | Personal Finance Management | HSSM | T | 2 | - | 2 | - | 2 |
| EC 207 | Human Values and Social Ethics | | T | 2 | - | 2 | - | 2 |
| EC 208 | Analog & Digital Electronics Lab | PCC | LP | - | 2 | - | 1 | 1 |
| **Total** | | | | **19** | **6** | **19** | **3** | **22** |

| Course Code | Course Name | Category | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Theory | | | | | Term Work | Pract /Oral | Total |
| | | | Internal Assessment | | | End Sem Exam | Exam Duration (Hrs) | | | |
| | | | 1 | 2 | Avg | | | | | |
| EC 201 | Engineering Mathematics III | ESC | 40 | 40 | 40 | 60 | 2 | - | - | 100 |
| EC 202 | Analog Electronics Circuits | PCC | 40 | 40 | 40 | 60 | 2 | - | - | 100 |
| EC 203 | Digital Circuits & System Design | PCC | 40 | 40 | 40 | 60 | 2 | - | - | 100 |
| EC 204 | Data Structures & Algorithms | MDM | 40 | 40 | 40 | 60 | 2 | 25 | 25 | 150 |
| EC 205 | Database Management System | PCC | 40 | 40 | 40 | 60 | 2 | 25 | 25 | 150 |
| EC 206 | Personal Finance Management | HSSM | 20 | 20 | 20 | 40 | 2 | - | - | 60 |
| EC 207 | Human Values and Social Ethics | | - | - | - | - | - | 50 | - | 50 |
| EC 208 | Analog & Digital Electronics Lab | PCC | - | - | - | - | - | 25 | 25 | 50 |
| **Total** | | | | | | | | | | **760** |

1# to be taken class wise **T- Theory , L- Lab , P-Programming, C- Communicatio**

Adm Y23-24

## Semester IV

| Course Code | Course Name | Category | Course Component | Teaching Scheme (Contact Hours) | | Credits Assigned | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | Pract/Tuts | Theory | Pract/Tuts | Total |
| EC 209 | Engineering Mathematics IV | ESC | T | 3 | - | 3 | - | 3 |
| EC 210 | Analysis of Algorithms | PCC | T | 3 | 2 | 3 | 1 | 4 |
| EC 211 | Basics of VLSI Design | PCC | TLP | 3 | 2 | 3 | 1 | 4 |
| EC 212 | System Software and Operating Systems | MDM | T | 3 | - | 3 | - | 3 |
| EC 213 | Microprocessor and Microcontroller | PCC | T | 3 | 2 | 3 | 1 | 4 |
| EC 214 | Entrepreneurship | HSSM | T | 2 | - | 2 | - | 2 |
| EC 215 | System Software and Operating Systems Lab | Skill Courses | L | - | 2 | - | 1 | 1 |
| EC 291 | Programming Lab I ( Java Programming) | Experiential Learning Courses | LP LPC | - | 1*+ 2 | - | 1 | 1 |
| **Total** | | | | **17** | **11** | **17** | **5** | **22** |

| Course Code | Course Name | Category | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Theory | | | | | Term Work | Pract/ Oral | Total |
| | | | Internal Assessment | | | End Sem Exam | Exam Duration (Hrs) | | | |
| | | | 1 | 2 | Avg | | | | | |
| EC 209 | Engineering Mathematics IV | ESC | 40 | 40 | 40 | 60 | 2 | - | - | 100 |
| EC 210 | Analysis of Algorithms | PCC | 40 | 40 | 40 | 60 | 2 | 25 | 25 | 150 |
| EC 211 | Basics of VLSI Design | PCC | 40 | 40 | 40 | 60 | 2 | 25 | 25 | 150 |
| EC 212 | System Software and Operating Systems | MDM | 40 | 40 | 40 | 60 | 2 | - | - | 100 |
| EC 213 | Microprocessor and Microcontroller | PCC | 40 | 40 | 40 | 60 | 2 | 25 | 25 | 150 |
| EC 214 | Entrepreneurship | HSSM | 20 | 20 | 20 | 40 | 2 | - | - | 60 |
| EC 215 | System Software and Operating Systems Lab | Skill Courses | - | - | - | - | - | 25 | 25 | 50 |
| EC 291 | Programming Lab I ( Java Programming) | Skill Courses | - | - | - | - | - | 25 | 25 | 50 |
| **Total** | | | | | | | | | | **810** |

1# to be taken class wise

**T- Theory , L- Lab , P-Programming, C- Communication**

Adm Y 23-24

## Semester V

| Course Code | Course Name | Category | Course Component | Teaching Scheme (Contact Hours) | | Credits Assigned | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | Pract/ Tuts | Theory | Pract / Tuts | Total |
| EC 301 | Signals and Systems | PCC | TL | 3 | 1 | 3 | 1 | 4 |
| EC 302 | Computer Networks | PCC | TL | 3 | 2 | 3 | 1 | 4 |
| EC 303 | Professional Communication and Ethics II | AEC | LC | 1 | 2 | 1 | 1 | 2 |
| EC 304 | Software Engineering | MDM | T | 3 | - | 3 | - | 3 |
| EC 3xx | Department Level Optional Course I | PEC | TL | 3 | 2 | 3 | 1 | 4 |
| IL 3xx | Institute Level Optional Course I | Open Elective Courses (OEC) | T | 3 | - | 3 | - | 3 |
| EC 391 | Programming Lab II(Web Programming) | Skill Courses | LPC | 1 | 2 | 1 | 1 | 2 |
| **Total** | | | | **17** | **9** | **17** | **5** | **22** |

| Course Code | Course Name | Category | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Theory | | | | | Term Work | Pract / Oral | Total |
| | | | Internal Assessment | | | End Sem Exam | Exam Duration (Hrs) | | | |
| | | | 1 | 2 | Avg | | | | | |
| EC 301 | Signals & Systems | PCC | 40 | 40 | 40 | 60 | 2 | 25 | - | 125 |
| EC 302 | Computer Networks | PCC | 40 | 40 | 40 | 60 | 2 | 25 | 25 | 150 |
| EC 303 | Professional Communication and Ethics II | AEC | - | - | - | - | - | 50 | - | 50 |
| EC 304 | Software Engineering | MDM | 40 | 40 | 40 | 60 | 2 | - | - | 100 |
| EC 3xx | Department Level Optional Course I | PEC | 40 | 40 | 40 | 60 | 2 | 25 | 25 | 150 |
| IL 3xx | Institute Level Optional Course I | Open Elective (OE) | 40 | 40 | 40 | 60 | 2 | - | - | 100 |
| EC 391 | Programming Lab II(Web Programming) | Skill Courses | - | - | - | - | - | 25 | 25 | 50 |
| **Total** | | | | | | | | | | **725** |

**T- Theory , L- Lab , P-Programming, C- Communication**

Adm Y 23-24

| Course Code | Department Level Optional Course (DLOC) I | Specializations |
|---|---|---|
| EC 305 | Artificial Intelligence | AIML |
| EC 306 | Advanced Database Management Systems + DWM | Data Analytics |
| EC 307 | Advanced Operating System | High Performance Computing |
| EC 308 | Embedded System Design & Basics of IOT | IOT |

| Course Code | Institute Level Optional Course (ILOC) I | Specializations |
|---|---|---|
| IL 360 | IPR and Patenting | **IP Management and Digital Business** |
| IL 361 | E- Commerce and E-Business | **Business Management** |
| IL 362 | Introduction to Bioengineering | **Bio Engineering** |
| IL 363 | Biomedical Instrumentation | **Bio Instrumentation** |
| IL 364 | Design of Experiments | **Engineering Design** |
| IL 365 | Design for Sustainability | **Sustainable Technologies** |
| IL 366 | Political Science | **Contemporary Studies** |
| IL 367 | Visual Arts | **Art and Journalism** |
| IL 368 | Modern Day Sensor Physics | **Applied Science** |
| IL 369 | Energy Audit and Management | **Green Technologies** |
| IL 370 | Maintenance of Electronics Equipment | **Maintenance Engineering** |
| IL 371 | Cooking and Nutrition | **Life Skills** |
| IL 372 | Environmental Management | **Environment** |
| IL 373 | Vehicle Safety | **Safety** |
| IL 388 | Quantum Computing and Technologies I | **Quantum Computing and Technologies** |

Adm Y 23-24

## Semester VI

| Course Code | Course Name | Category | Course Component | Teaching Scheme (Contact Hours) | | Credits Assigned | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | Pract/ Tuts | Theory | Pract/ Tuts | Total |
| EC 309 | Instrumentation and Control System | PCC | TLP | 3 | - | 3 | - | 3 |
| EC 310 | Computer Organization and Architecture | PCC | T | 3 | - | 3 | - | 3 |
| EC 311 | Software Testing and Quality Assurance | MDM | T | 3 | - | 3 | - | 3 |
| EC 3xx | Department Level Optional Course II | PEC | TL | 3 | 2 | 3 | 1 | 4 |
| EC 3xx | Department Level Optional Course III | PEC | TL | 3 | 2 | 3 | 1 | 4 |
| IL 3xx | Institute Level Optional Course II | Open Elective (OE) | T | 3 | - | 3 | - | 3 |
| EC 392 | Project A | Experiential Learning Courses | LPC | - | 4 | - | 2 | 2 |
| **Total** | | | | **18** | **8** | **18** | **4** | **22** |

| Course Code | Course Name | Category | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Theory | | | | | Term Work | Pract/ Oral | Total |
| | | | Internal Assessment | | | End Sem Exam | Exam Duration (Hrs) | | | |
| | | | 1 | 2 | Avg | | | | | |
| EC 309 | Instrumentation and Control System | PCC | 40 | 40 | 40 | 60 | 2 | - | - | 100 |
| EC 310 | Computer Organization and Architecture | PCC | 40 | 40 | 40 | 60 | 2 | - | - | 100 |
| EC 311 | Software Testing and Quality Assurance | MDM | 40 | 40 | 40 | 60 | 2 | - | - | 100 |
| EC 3xx | Department Level Optional Course II | PEC | 40 | 40 | 40 | 60 | 2 | 25 | 25 | 150 |
| EC 3xx | Department Level Optional Course III | PEC | 40 | 40 | 40 | 60 | 2 | 25 | 25 | 150 |
| IL 3xx | Institute Level Optional Course II | Open Elective (OE) | 40 | 40 | 40 | 60 | 2 | - | - | 100 |
| EC 392 | Project A | Experiential Learning Courses | - | - | - | - | - | 50 | 50 | 100 |
| **Total** | | | | | | | | | | **800** |

**T- Theory , L- Lab , P-Programming, C- Communication**

Adm Y 23-24

| Course Code | Department Level Optional Course (DLOC) II | Specializations |
|---|---|---|
| EC 312 | Foundations of Robotics | Robotics |
| EC 313 | Cryptography and System Security | System Security |
| EC 314 | Mobile & Distributed Computing | Cloud Computing |
| EC 315 | Integrated Circuit Technology | VLSI Design |

| Course Code | Department Level Optional Course (DLOC) III | Specializations |
|---|---|---|
| EC 316 | Machine Learning | AIML |
| EC 317 | Big Data Analytics | Data Analytics |
| EC 318 | Parallel Computing Architecture | High Performance Computing |
| EC 319 | Wireless Networks | IOT |

Adm Y 23-24

| Course Code | Institute Level Optional Course (ILOC) II | Specializations |
|---|---|---|
| IL 374 | Digital Business Management and Digital Marketing | **Entrepreneurship Development and Management** |
| IL 375 | Business Analytics | **Business Management** |
| IL 376 | Biomechanics | **Bioengineering** |
| IL 377 | Medical Image Processing | **Bio Instrumentation** |
| IL 378 | Product Design | **Engineering Design** |
| IL 379 | Technologies for Rural Development | **Sustainable Technologies** |
| IL 380 | Economics | **Contemporary Studies** |
| IL 381 | Journalism, Media and Communication studies | **Art and Journalism** |
| IL 382 | Operation Research for Management | **Applied Science** |
| IL 383 | Weather and Climate Informatics | **Green Technologies** |
| IL 384 | Maintenance of Mechanical Equipment | **Maintenance Engineering** |
| IL 385 | Physical Education | **Life Skills** |
| IL 386 | Industrial Regulations and Laws | **Environment** |
| IL 387 | Industrial and high voltage Safety | **Safety** |
| IL 389 | Quantum Computing and Quantum Technologies II | **Quantum Computing and Quantum Technologies** |

Adm Y 2024

## Semester VII

| Course Code | Course Name | Category | Course Component | Teaching Scheme (Contact Hours) | | Credits Assigned | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | Pract/ Tuts | Theory | Pract/Tuts | Total |
| EC 401 | Image Processing & Machine Vision | PCC | T | 3 | 2 | 3 | 1 | 4 |
| EC 4xx | Department Level Optional Course IV | PEC | TL | 3 | 2 | 3 | 1 | 4 |
| EC 4xx | Department Level Optional Course V | PEC | TL | 3 | 2 | 3 | 1 | 4 |
| EC 491 | Programming Lab III (R-Programming) | PCC | LPC | - | 1*+ 2 | - | 1 | 2 |
| EC 492 | Multidisciplinary Minor Project | MDM/ Open Elective (OE) | T | 2 | - | 2 | - | 2 |
| EC 493 | Project B | Experiential Learning Courses | LPC | - | 8 | - | 4 | 4 |
| **Total** | | | | **12** | **14** | **12** | **7** | **20** |

| Course Code | Course Name | Category | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Theory | | | | | Term Work | Pract/ Oral | Total |
| | | | Internal Assessment | | | End Sem Exam | Exam Duration (Hrs) | | | |
| | | | 1 | 2 | Avg | | | | | |
| EC 401 | Image Processing & Machine Vision | PCC | 40 | 40 | 40 | 60 | 2 | 25 | 25 | 150 |
| EC 4xx | Department Level Optional Course IV | PEC | 40 | 40 | 40 | 60 | 2 | 25 | 25 | 150 |
| EC 4xx | Department Level Optional Course V | PEC | 40 | 40 | 40 | 60 | 2 | 25 | 25 | 150 |
| EC 491 | Programming Lab III (R-Programming) | PCC | - | - | - | - | - | 25 | 25 | 50 |
| EC 492 | Multidisciplinary Minor Course | MDM/ Open Elective (OE) | - | - | - | - | - | 25 | 25 | 50 |
| EC 493 | Project B | Experiential Learning Courses | - | - | - | - | - | 50 | 100 | 150 |
| **Total** | | | | | | | | | | **700** |

**T- Theory , L- Lab , P-Programming, C- Communication**

Adm Y 23-24

| Course Code | Department Level Optional Course (DLOC) IV | Specializations |
|---|---|---|
| EC 402 | Advanced Robotics | Robotics |
| EC 403 | Advanced Network Theory | System Security |
| EC 404 | Cloud Computing | Cloud Computing |
| EC 405 | Advanced VLSI Design | VLSI Design |

| Course Code | Department Level Optional Course (DLOC) V | Specializations |
|---|---|---|
| EC 406 | Deep Learning | AIML |
| EC 407 | Data Science | Data Analytics |
| EC 408 | High Performance Computing | High Performance Computing |
| EC 409 | Internet of Everything | IOT |

Adm Y 2024

## Semester VIII

| Course Code | Course Name | Category | Course Component | Teaching Scheme (Contact Hours) | | Credits Assigned | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | Pract | Theory | Pract | Total |
| EC 410 | Research Methodology | Experiential Learning Courses | T | 4 | - | 4 | - | 4 |
| EC 4xx | Department Level Optional Course VI | PEC | TL | 3 | 2 | 3 | 1 | 4 |
| EC 494 | Project C | Experiential Learning Courses | LPC | - | 6 | - | 3 | 3 |
| EC 495 | Internship/ OJT | Experiential Learning Courses | LPC | - | 16 | - | 8 | 8 |
| **Total** | | | | **7** | **24** | **7** | **12** | **19** |

| Course Code | Course Name | Category | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Theory | | | | | | | |
| | | | Internal Assessment | | | End Sem Exam | Exam Duration (Hrs) | Term Work | Pract/Oral | Total |
| | | | 1 | 2 | Avg | | | | | |
| EC 410 | Research Methodology | Experiential Learning Courses | 40 | 40 | 40 | 60 | 2 | - | - | 100 |
| EC 4xx | Department Level Optional Course VI | PEC | 40 | 40 | 40 | 60 | 2 | 25 | 25 | 150 |
| EC 494 | Project C | Experiential Learning Courses | - | - | - | - | - | 50 | 50 | 100 |
| EC 495 | Internship/ OJT | Experiential Learning Courses | 50 | 50 | 50 | - | - | 50 | 100 | 200 |
| **Total** | | | | | | | | | | **550** |

**T- Theory , L- Lab , P-Programming, C- Communication**

| Course Code | Department Level Optional Course (DLOC) VI | Specializations |
|---|---|---|
| EC 411 | Intelligent Robotics | Robotics |
| EC 412 | Cyber Security & Digital Forensic | System Security |
| EC 413 | Blockchain Technology | Cloud Computing |

Adm Y 23-24

| | | |
|---|---|---|
| EC 414 | Analog and Mixed Signal VLSI Design | VLSI Design |

Adm Y 23-24

Mahatma Education Society's

# Pillai College of Engineering

## *(Autonomous)*

## Affiliated to University of Mumbai

Dr. K. M. Vasudevan Pillai's Campus , Sector 16, New Panvel – 410 206.

## Department of Electronics & Computer Science

**Syllabus**

*of*

## B.Tech. in Electronics & Computer Science

*for*

**The Admission Batch of AY 2023-24**

**First Year -** Effective from Academic Year **2023-24**

**Second Year -** Effective from Academic Year **2024-25**

**Third Year -** Effective from Academic Year **2025-26**

**Fourth Year -** Effective from Academic Year **2026-27**

*as per Choice Based Credit and Grading System*

Adm 2023-24

Mahatma Education Society's

# Pillai College of Engineering

## Vision

Pillai College of Engineering (PCE) will admit, educate and train a diverse population of students who are academically prepared to benefit from the Institute's infrastructure and faculty experience, to become responsible professionals or entrepreneurs in a technical arena. It will further attract, develop and retain, dedicated, excellent teachers, scholars and professionals from diverse backgrounds whose work gives them knowledge beyond the classroom and who are committed to making a significant difference in the lives of their students and the community.

## Mission

To develop professional engineers with respect for the environment and make them responsible citizens in technological development both from an Indian and global perspective. This objective is fulfilled through quality education, practical training and interaction with industries and social organizations.

Y23-24

Dr. K. M. Vasudevan Pillai's Campus , Sector - 16, New Panvel – 410 206

# Department of Electronics & Computer Science

## Vision

To produce professionally competent and socially responsible engineers capable of working globally.

## Mission

To provide in-depth quality education in Electronics & Computer Science Engineering and prepare the students for lifelong learning.

To develop professional engineers who can critically and creatively apply the knowledge of engineering principles to solve real world problems.

To inculcate entrepreneurship skills and impart ethical and social values.

## Program Educational Objectives (PEOs):

I. Graduates will have the ability to apply engineering knowledge and skills to provide solutions to real world technical problems.
II. Graduates will be successful as engineering professionals, innovators or entrepreneurs with a multidisciplinary approach contributing towards research and technological developments.
III. Graduates will have the ability to pursue higher education in Electronics Engineering, Computer Science and allied streams.
IV. Graduates will function in their profession with social awareness and responsibility while maintaining ethical standards.

## Program Outcomes:

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

Adm Y 23-24

appropriate consideration for 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 of 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 the 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 teamwork: 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 work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. Life-long learning: Recognized 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 Outcomes (PSOs):

Engineering Graduates will be able to

1. Gain knowledge and skills to analyse and design Electronics circuits as well as Computer Programs.
2. Develop hardware and software systems in the areas like Artificial Intelligence & Machine learning, Big Data, Information Security, Automation, Embedded Systems, Signal Processing and Communication Systems.
3. Apply modern Electronics and Computer engineering techniques and tools to find solutions for real life interdisciplinary problems.

Adm Y23-24

The Autonomous status of the institute has given an opportunity to design and frame the curriculum in such a way that it incorporates all the needs and requirements of recent developments in all fields within the scope of the Technical education. This curriculum will help graduates to attain excellence in their respective field. The curriculum has a blend of basic and advanced courses along with provision of imparting practical knowledge to students through minor and major projects. The syllabus has been approved and passed by the Board of Studies.

Outcome based education is implemented in the academics and every necessary step is undertaken to attain the requirements. Every course has its objectives and outcomes defined in the syllabus which are met through continuous assessment and end semester examinations. Evaluation is done on the basis of Choice Based Credit and Grading System (CBCGS). Optional courses are offered at department and institute level. Selection of electives from the same specialization makes the student eligible to attain a B. Tech. degree with respective specialization.

Every learner/student will be assessed for each course through (i) an Internal/Continuous assessment during the semester in the form of either Practical Performance, Presentation, Demonstration or written examination and (ii) End Semester Examination (ESE), in the form of either theory or viva voce or practical, as prescribed by the respective Board Studies and mentioned in the assessment scheme of the course content/syllabus. This system involves the Continuous Evaluation of students' progress Semester wise. The number of credits assigned with a course is based on the number of contact hours of instruction per week for the course. The credit allocation is available in the syllabus scheme of each semester.

The performance of a learner in a semester is indicated by a number called Semester Grade Performance Index (SGPI). The SGPI is the weighted average of the grade points obtained in all the courses by the learner during the semester. For example, if a learner passes five courses (Theory/labs./Projects/ Seminar etc.) in a semester with credits C1, C2, C3, C4 and C5 and learners grade points in these courses are G1, G2, G3, G4 and G5 respectively, then learners SGPI is equal to:

$$SGPI = \frac{C_1G_1 + C_2G_2 + C_3G_3 + C_4G_4 + C_5G_5}{C_1 + C_2 + C_3 + C_4 + C_5}$$

The learner's up to date assessment of the overall performance from the time s/he entered for the programme is obtained by calculating a number called the Cumulative Grade Performance Index (CGPI), in a manner similar to the calculation of SGPI. The CGPI therefore considers all the courses mentioned in the scheme of instructions and examinations, towards the minimum requirement of the degree learners have enrolled for. The CGPI at the end of this semester is calculated as,

$$CGPI = \frac{C_1G_1 + C_2G_2 + C_3G_3 + \ldots + C_i * G_i + \ldots + C_nG_n}{C_1 + C_2 + C_3 + \cdots + C_i + \ldots + C_n}$$

The Department of Electronics & Computer Science offers a B. Tech. programme in Electronics & Computer Science. This is an eight semester course. The complete course is a 163 credit course which comprises core courses and elective courses. The elective courses are distributed over 8 specializations. The specializations are:

1. AIML
2. Robotics
3. Data Analytics
4. System Security
5. High Performance Computing
6. Cloud Computing
7. VLSI Design
8. IOT

The students also have a choice of opting for Institute level specializations. These are

1. Entrepreneurship Development and Management
2. Business Management
3. Intellectual Property Management
4. Bioengineering
5. Bio Instrumentation
6. Engineering Design
7. Sustainable Technologies
8. Contemporary Studies
9. Art and Journalism
10. Applied Science
11. Green Technologies
12. Maintenance Engineering
13. Life Skills
14. Environment & Safety

**As minimum requirements for the credits to be earned during the B.Tech in Electronics & Computer Science program, a student will have to complete a minimum of three specializations of which two are to be chosen from the department list and one has to be from the Institute level specialization list. In order to complete each specialization, a minimum of three courses under that specialization has to be completed.**

Adm Y 23-24

# Semester I

| Course Code | Course Name | Category | Course Component | Teaching Scheme (Contact Hours) | | Credits Assigned | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | Pract/ Tuts | Theory | Pract /Tuts | Total |
| FY 101 | Engineering Mathematics I | BSC | TLP | 3 | 2 | 3 | 1 | 4 |
| FY 102 | Engineering Physics I | BSC | TL | 2 | 1 | 2 | 0.5 | 2.5 |
| FY 103 | Engineering Chemistry I | BSC | TL | 2 | 1 | 2 | 0.5 | 2.5 |
| FY 104 | C Programming | ESC | T | 3 | - | 3 | - | 3 |
| FY 105 | Basic Electrical Engineering | ESC | TL | 3 | 2 | 3 | 1 | 4 |
| FY 108 | C Programming Lab | Skill | LP | - | 2 | - | 1 | 1 |
| FY 111 | Basic Workshop I | Skill | LP | - | 2 | - | 1 | 1 |
| FY 113 | Indian Knowledge System | HSSM | T | - | 2+2# | - | 2 | 2 |
| FY 114 | Co-curricular Course I | Liberal Learning | L | - | 4 | - | 2 | 2 |
| **Total** | | | | **13** | **18** | **13** | **9** | **22** |

| Course Code | Course Name | Category | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Theory | | | | | Term Work | Pract /Oral | Total |
| | | | Internal Assessment | | | End Sem Exam | Exam Duration (Hrs) | | | |
| | | | 1 | 2 | Avg | | | | | |
| FY 101 | Engineering Mathematics I | BSC | 40 | 40 | 40 | 60 | 2 | 25 | - | 125 |
| FY 102 | Engineering Physics I | BSC | 30 | 30 | 30 | 45 | 2 | 25 | - | 100 |
| FY 103 | Engineering Chemistry I | BSC | 30 | 30 | 30 | 45 | 2 | 25 | - | 100 |
| FY 104 | C Programming | ESC | 40 | 40 | 40 | 60 | 2 | - | - | 100 |
| FY 105 | Basic Electrical Engineering | ESC | 40 | 40 | 40 | 60 | 2 | 25 | 25 | 150 |
| FY 108 | C Programming Lab | Skill | - | - | - | - | - | 25 | 25 | 50 |
| FY 111 | Basic Workshop I | Skill | - | - | - | - | - | 50 | - | 50 |
| FY 113 | *Indian Knowledge System* | HSSM | - | - | - | - | - | 50 | - | 50 |
| FY 114 | Co-curricular Course I | Liberal Learning | - | - | - | - | - | 50 | - | 50 |
| **Total** | | | | | | | | | | **775** |

**T- Theory , L- Lab , P-Programming, C- Communication**

Aqm Y23-24

# Semester II

| Course Code | Course Name | Category | Course Component | Teaching Scheme (Contact Hours) | | Credits Assigned | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | Pract/ Tuts | Theory | Pract /Tuts | Total |
| FY 107 | Engineering Mechanics and Graphics | ESC | TL | 3 | 2 | 3 | 1 | 4 |
| FY 115 | Engineering Mathematics II | BSC | TLP | 3 | 2 | 3 | 1 | 4 |
| FY 116 | Engineering Physics II | BSC | TL | 2 | 1 | 2 | 0.5 | 2.5 |
| FY 117 | Engineering Chemistry II | BSC | TL | 2 | 1 | 2 | 0.5 | 2.5 |
| FY 119 | Python Programming | Program Courses | TLP | 3 | - | 3 | - | 3 |
| FY 121 | Professional Communication & Ethics I | HSSM | TL | 1 | 2 | 1 | 1 | 2 |
| FY 122 | Python Programming lab | Skill | LP | - | 2 | - | 1 | 1 |
| FY 123 | Basic Workshop II | Skill | LP | - | 2 | - | 1 | 1 |
| FY 125 | Co-curricular Course II | *Liberal Learning* | | - | 4 | - | 2 | 2 |
| **Total** | | | | **14** | **16** | **14** | **8** | **22** |

| Course Code | Course Name | Category | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Theory | | | | | Term Work | Pract/ Oral | Total |
| | | | Internal Assessment | | | End Sem Exam | Exam Duration (Hrs) | | | |
| | | | 1 | 2 | Avg | | | | | |
| FY 107 | Engineering Mechanics and Graphics | ESC | 40 | 40 | 40 | 60 | 3 | 25 | 25 | 150 |
| FY 115 | Engineering Mathematics II | BSC | 40 | 40 | 40 | 60 | 2 | 25 | - | 125 |
| FY 116 | Engineering Physics II | BSC | 30 | 30 | 30 | 45 | 2 | 25 | - | 100 |
| FY 117 | Engineering Chemistry II | BSC | 30 | 30 | 30 | 45 | 2 | 25 | - | 100 |
| FY 119 | Python Programming | Program Courses | 40 | 40 | 40 | 60 | 2 | - | - | 100 |
| FY 121 | Professional Communication & Ethics I | HSSM | **20** | **20** | 20 | 30 | 1 | 25 | - | 75 |
| FY 122 | Python Programming lab | Skill | - | - | - | - | - | 25 | 25 | 50 |
| FY 123 | Basic Workshop II | Skill | - | - | - | - | - | 50 | - | 50 |
| FY 125 | Co-curricular Course II | *Liberal Learning* | - | - | - | - | - | 50 | - | 50 |
| **Total** | | | | | | | | | | **800** |

Aqm Y 23-24

## Semester III

| Course Code | Course Name | Category | Course Component | Teaching Scheme (Contact Hours) | | Credits Assigned | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | Pract /Tuts | Theory | Pract /Tuts | Total |
| EC 201 | Engineering Mathematics III | ESC | T | 3 | - | 3 | - | 3 |
| EC 202 | Analog Electronics Circuits | PCC | TL | 3 | - | 3 | | 3 |
| EC 203 | Digital Circuits & System Design | PCC | TL | 3 | - | 3 | - | 3 |
| EC 204 | Data Structures & Algorithms | MDM | TL | 3 | 2 | 3 | 1 | 4 |
| EC 205 | Database Management System | PCC | TLP | 3 | 2 | 3 | 1 | 4 |
| EC 206 | Personal Finance Management | HSSM | T | 2 | - | 2 | - | 2 |
| EC 207 | Human Values and Social Ethics | | T | 2 | - | 2 | - | 2 |
| EC 208 | Analog & Digital Electronics Lab | PCC | LP | - | 2 | - | 1 | 1 |
| **Total** | | | | **19** | **6** | **19** | **3** | **22** |

| Course Code | Course Name | Category | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Theory | | | | | Term Work | Pract /Oral | Total |
| | | | Internal Assessment | | | End Sem Exam | Exam Duration (Hrs) | | | |
| | | | 1 | 2 | Avg | | | | | |
| EC 201 | Engineering Mathematics III | ESC | 40 | 40 | 40 | 60 | 2 | - | - | 100 |
| EC 202 | Analog Electronics Circuits | PCC | 40 | 40 | 40 | 60 | 2 | - | - | 100 |
| EC 203 | Digital Circuits & System Design | PCC | 40 | 40 | 40 | 60 | 2 | - | - | 100 |
| EC 204 | Data Structures & Algorithms | MDM | 40 | 40 | 40 | 60 | 2 | 25 | 25 | 150 |
| EC 205 | Database Management System | PCC | 40 | 40 | 40 | 60 | 2 | 25 | 25 | 150 |
| EC 206 | Personal Finance Management | HSSM | 20 | 20 | 20 | 40 | 2 | - | - | 60 |
| EC 207 | Human Values and Social Ethics | | - | - | - | - | - | 50 | - | 50 |
| EC 208 | Analog & Digital Electronics Lab | PCC | - | - | - | - | - | 25 | 25 | 50 |
| **Total** | | | | | | | | | | **760** |

1# to be taken class wise **T- Theory , L- Lab , P-Programming, C- Communicatio**

Adm Y23-24

## Semester IV

| Course Code | Course Name | Category | Course Component | Teaching Scheme (Contact Hours) | | Credits Assigned | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | Pract/Tuts | Theory | Pract/Tuts | Total |
| EC 209 | Engineering Mathematics IV | ESC | T | 3 | - | 3 | - | 3 |
| EC 210 | Analysis of Algorithms | PCC | T | 3 | 2 | 3 | 1 | 4 |
| EC 211 | Basics of VLSI Design | PCC | TLP | 3 | 2 | 3 | 1 | 4 |
| EC 212 | System Software & Operating Systems | MDM | T | 3 | - | 3 | - | 3 |
| EC 213 | Microprocessor and Microcontrollers | PCC | T | 3 | 2 | 3 | 1 | 4 |
| EC 214 | Entrepreneurship | HSSM | T | 2 | - | 2 | - | 2 |
| EC 215 | System Software & Operating Systems Lab | Skill Courses | L | - | 2 | - | 1 | 1 |
| EC 291 | Programming Lab I ( Java Programming) | Experiential Learning Courses | LP LPC | - | 1*+ 2 | - | 1 | 1 |
| **Total** | | | | **17** | **11** | **17** | **5** | **22** |

| Course Code | Course Name | Category | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Theory | | | | | Term Work | Pract/ Oral | Total |
| | | | Internal Assessment | | | End Sem Exam | Exam Duration (Hrs) | | | |
| | | | 1 | 2 | Avg | | | | | |
| EC 209 | Engineering Mathematics IV | ESC | 40 | 40 | 40 | 60 | 2 | - | - | 100 |
| EC 210 | Analysis of Algorithms | PCC | 40 | 40 | 40 | 60 | 2 | 25 | 25 | 150 |
| EC 211 | Basics of VLSI Design | PCC | 40 | 40 | 40 | 60 | 2 | 25 | 25 | 150 |
| EC 212 | System Software & Operating Systems | MDM | 40 | 40 | 40 | 60 | 2 | - | - | 100 |
| EC 213 | Microprocessor and Microcontroller | PCC | 40 | 40 | 40 | 60 | 2 | 25 | 25 | 150 |
| EC 214 | Entrepreneurship | HSSM | 20 | 20 | 20 | 40 | 2 | - | - | 60 |
| EC 215 | System Software & Operating Systems Lab | Skill Courses | - | - | - | - | - | 25 | 25 | 50 |
| EC 291 | Programming Lab I ( Java Programming) | Skill Courses | - | - | - | - | - | 25 | 25 | 50 |
| **Total** | | | | | | | | | | **810** |

1# to be taken class wise

**T- Theory , L- Lab , P-Programming, C- Communication**

Adm Y 23-24

## Semester V

| Course Code | Course Name | Category | Course Component | Teaching Scheme (Contact Hours) | | Credits Assigned | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | Pract/ Tuts | Theory | Pract / Tuts | Total |
| EC 301 | Signals & Systems | PCC | TL | 3 | 1 | 3 | 1 | 4 |
| EC 302 | Computer Networks | PCC | TL | 3 | 2 | 3 | 1 | 4 |
| EC 303 | Professional Communication and Ethics II | AEC | LC | 1 | 2 | 1 | 1 | 2 |
| EC 304 | Software Engineering | MDM | T | 3 | - | 3 | - | 3 |
| EC 3xx | Department Level Optional Course I | PEC | TL | 3 | 2 | 3 | 1 | 4 |
| IL 3xx | Institute Level Optional Course I | Open Elective (OE) | T | 2 | - | 2 | - | 3 |
| EC 391 | Programming Lab II(Web Programming) | Skill Courses | LPC | 1 | 2 | 1 | 1 | 2 |
| **Total** | | | | **15** | **12** | **15** | **6** | **22** |

| Course Code | Course Name | Category | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Theory | | | | | Term Work | Pract / Oral | Total |
| | | | Internal Assessment | | | End Sem Exam | Exam Duration (Hrs) | | | |
| | | | 1 | 2 | Avg | | | | | |
| EC 301 | Signals & Systems | PCC | 40 | 40 | 40 | 60 | 2 | 25 | - | 125 |
| EC 302 | Computer Networks | PCC | 40 | 40 | 40 | 60 | 2 | 25 | 25 | 150 |
| EC 303 | Professional Communication and Ethics II | AEC | - | - | - | - | - | 50 | - | 50 |
| EC 304 | Software Engineering | MDM | 40 | 40 | 40 | 60 | 2 | 25 | 25 | 150 |
| EC 3xx | Department Level Optional Course I | PEC | 40 | 40 | 40 | 60 | 2 | 25 | 25 | 150 |
| IL 3xx | Institute Level Optional Course I | Open Elective (OE) | 30 | 30 | 30 | 45 | 2 | - | - | 75 |
| EC 391 | Programming Lab II(Web Programming) | Skill Courses | - | - | - | - | - | 25 | 25 | 50 |
| **Total** | | | | | | | | | | **750** |

1[#] to be taken class wise

**T- Theory , L- Lab , P-Programming, C- Communication**

Adm Y 23-24

| Course Code | Department Level Optional Course (DLOC) I | Specializations |
|---|---|---|
| EC 305 | Artificial Intelligence | AIML |
| EC 306 | Advanced Database Management Systems + DWM | Data Analytics |
| EC 307 | Advanced Operating System | High Performance Computing |
| EC 308 | Embedded System Design & Basics of IOT | IOT |

| Course Code | Institute Level Optional Course (ILOC) I | Specializations |
|---|---|---|
| IL 360 | Entrepreneurship | **Entrepreneurship Development and Management** |
| IL 361 | E- Commerce and E-Business | **Business Management** |
| IL 362 | Research Methodology | **Intellectual Property Management** |
| IL 363 | Introduction to Bioengineering | **Bioengineering** |
| IL 364 | Biomedical Instrumentation | **Bio Instrumentation** |
| IL 365 | Design of Experiments | **Engineering Design** |
| IL 366 | Design for Sustainability | **Sustainable Technologies** |
| IL 367 | Political Science | **Contemporary Studies** |
| IL 368 | Visual Art | **Art and Journalism** |
| IL 369 | Modern Day Sensor Physics | **Applied Science** |
| IL 370 | Energy Audit and Management | **Green Technologies** |
| IL 371 | Maintenance of Electronics Equipment | **Maintenance Engineering** |
| IL 372 | Cooking and Nutrition | **Life Skills** |
| IL 373 | Environmental Management | **Environment & Safety** |

Adm Y 2024

## Semester VI

| Course Code | Course Name | Category | Course Component | Teaching Scheme (Contact Hours) | | Credits Assigned | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | Pract/ Tuts | Theory | Pract/ Tuts | Total |
| EC 309 | Instrumentation and Control System | PCC | TLP | 3 | - | 3 | - | 3 |
| EC 310 | Computer Organization & Architecture | PCC | T | 3 | - | 3 | - | 3 |
| EC 311 | Software Testing & Quality Assurance | MDM | T | 3 | - | 3 | - | 3 |
| EC 3xx | Department Level Optional Course II | PEC | TL | 3 | 2 | 3 | 1 | 4 |
| EC 3xx | Department Level Optional Course III | PEC | TL | 3 | 2 | 3 | 1 | 4 |
| IL 3xx | Institute Level Optional Course II | Open Elective (OE) | T | 2 | - | 2 | - | 3 |
| EC 392 | Project A (Literature Survey & Problem Formulation) | Experiential Learning Courses | LPC | - | 4 | - | 2 | 2 |
| **Total** | | | | **14** | **13** | **14** | **6** | **22** |

| Course Code | Course Name | Category | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Theory | | | | | Term Work | Pract/ Oral | Total |
| | | | Internal Assessment | | | End Sem Exam | Exam Duration (Hrs) | | | |
| | | | 1 | 2 | Avg | | | | | |
| EC 309 | Instrumentation and Control System | PCC | 40 | 40 | 40 | 60 | 2 | - | - | 100 |
| EC 310 | Computer Organization & Architecture | PCC | 40 | 40 | 40 | 60 | 2 | - | - | 100 |
| EC 311 | Software Testing & Quality Assurance | MDM | 40 | 40 | 40 | 60 | 2 | - | - | 100 |
| EC 3xx | Department Level Optional Course II | PEC | 40 | 40 | 40 | 60 | 2 | 25 | 25 | 150 |
| EC 3xx | Department Level Optional Course III | PEC | 40 | 40 | 40 | 60 | 2 | 25 | 25 | 150 |
| IL 3xx | Institute Level Optional Course II | Open Elective (OE) | 30 | 30 | 30 | 45 | 2 | - | - | 75 |
| EC 392 | Project A (Literature Survey & Problem Formulation) | Experiential Learning Courses | - | - | - | - | - | 50 | 50 | 100 |
| **Total** | | | | | | | | | | **775** |

**T- Theory , L- Lab , P-Programming, C- Communication**

Adm Y23-24

| Course Code | Department Level Optional Course (DLOC) II | Specializations |
|---|---|---|
| EC 312 | Foundations of Robotics | Robotics |
| EC 313 | Cryptography and System Security | System Security |
| EC 314 | Mobile & Distributed Computing | Cloud Computing |
| EC 315 | Integrated Circuit Technology | VLSI Design |

| Course Code | Department Level Optional Course (DLOC) III | Specializations |
|---|---|---|
| EC 316 | Machine Learning | AIML |
| EC 317 | Big Data Analytics | Data Analytics |
| EC 318 | Parallel Computing Architecture | High Performance Computing |
| EC 319 | Wireless Networks | IOT |

Adm Y 23-24

| Course Code | Institute Level Optional Course (ILOC) II | Specializations |
|---|---|---|
| IL 374 | Digital Business Management and Digital Marketing | **Entrepreneurship Development and Management** |
| IL 375 | Business Analytics | **Business Management** |
| IL 376 | IPR and Patenting | **Intellectual Property Management** |
| IL 377 | Biomechanics | **Bioengineering** |
| IL 378 | Medical Image Processing | **Bio Instrumentation** |
| IL 379 | Product Design | **Engineering Design** |
| IL 380 | Technologies for Rural Development | **Sustainable Technologies** |
| IL 381 | Economics | **Contemporary Studies** |
| IL 382 | Journalism, Media and Communication studies | **Art and Journalism** |
| IL 383 | Operation Research for Management | **Applied Science** |
| IL 384 | Weather and Climate Informatics | **Green Technologies** |
| IL 385 | Maintenance of Mechanical Equipment | **Maintenance Engineering** |
| IL 386 | Physical Education | **Life Skills** |
| IL 387 | Vehicle Safety | **Environment & Safety** |

Adm Y 23-24

## Semester VII

| Course Code | Course Name | Category | Course Component | Teaching Scheme (Contact Hours) | | Credits Assigned | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | Pract/ Tuts | Theory | Pract/Tuts | Total |
| EC 401 | Image Processing & Machine Vision | PCC | T | 3 | 2 | 3 | 1 | 4 |
| EC 4xx | Department Level Optional Course IV | PEC | TL | 3 | 2 | 3 | 1 | 4 |
| EC 4xx | Department Level Optional Course V | PEC | TL | 3 | 2 | 3 | 1 | 4 |
| EC 491 | Programming Lab III (R-Programming) | PCC | LPC | - | 1*+ 2 | - | 1 | 2 |
| EC 492 | Multidisciplinary Minor Project | MDM/ Open Elective (OE) | T | 2 | - | 2 | - | 2 |
| EC 493 | Project B | Experiential Learning Courses | LPC | - | 8 | - | 4 | 4 |
| **Total** | | | | **12** | **14** | **12** | **7** | **20** |

| Course Code | Course Name | Category | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Theory | | | | | Term Work | Pract/ Oral | Total |
| | | | Internal Assessment | | | End Sem Exam | Exam Duration (Hrs) | | | |
| | | | 1 | 2 | Avg | | | | | |
| EC 401 | Image Processing & Machine Vision | PCC | 40 | 40 | 40 | 60 | 2 | 25 | 25 | 150 |
| EC 4xx | Department Level Optional Course IV | PEC | 40 | 40 | 40 | 60 | 2 | 25 | 25 | 150 |
| EC 4xx | Department Level Optional Course V | PEC | 40 | 40 | 40 | 60 | 2 | 25 | 25 | 150 |
| EC 491 | Programming Lab III (R-Programming) | PCC | - | - | - | - | - | 25 | 25 | 50 |
| EC 492 | Multidisciplinary Minor Course | MDM/ Open Elective (OE) | - | - | - | - | - | 25 | 25 | 50 |
| EC 493 | Project B | Experiential Learning Courses | - | - | - | - | - | 50 | 100 | 150 |
| **Total** | | | | | | | | | | **700** |

**T- Theory , L- Lab , P-Programming, C- Communication**

Adm Y 23-24

| Course Code | Department Level Optional Course (DLOC) IV | Specializations |
|---|---|---|
| EC 402 | Advanced Robotics | Robotics |
| EC 403 | Advanced Network Theory | System Security |
| EC 404 | Cloud Computing | Cloud Computing |
| EC 405 | Advanced VLSI Design | VLSI Design |

| Course Code | Department Level Optional Course (DLOC) V | Specializations |
|---|---|---|
| EC 406 | Deep Learning | AIML |
| EC 407 | Data Science | Data Analytics |
| EC 408 | High Performance Computing | High Performance Computing |
| EC 409 | Internet of Everything | IOT |

Adm Y 22-24

## Semester VIII

| Course Code | Course Name | Category | Course Component | Teaching Scheme (Contact Hours) | | Credits Assigned | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | Pract | Theory | Pract | Total |
| EC 410 | Research Methodology | Experiential Learning Courses | T | 4 | - | 4 | - | 4 |
| EC 4xx | Department Level Optional Course VI | PEC | TL | 3 | 2 | 3 | 1 | 4 |
| EC 494 | Project C | Experiential Learning Courses | LPC | - | 6 | - | 3 | 3 |
| EC 495 | Internship/ OJT | Experiential Learning Courses | LPC | - | 16 | - | 8 | 8 |
| **Total** | | | | **7** | **24** | **7** | **12** | **19** |

| Course Code | Course Name | Category | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Theory | | | | | | | |
| | | | Internal Assessment | | | End Sem Exam | Exam Duration (Hrs) | Term Work | Pract/Oral | Total |
| | | | 1 | 2 | Avg | | | | | |
| EC 410 | Research Methodology | Experiential Learning Courses | 40 | 40 | 40 | 60 | 2 | - | - | 100 |
| EC 4xx | Department Level Optional Course VI | PEC | 40 | 40 | 40 | 60 | 2 | 25 | 25 | 150 |
| EC 494 | Project C | Experiential Learning Courses | - | - | - | - | - | 50 | 50 | 100 |
| EC 495 | Internship/ OJT | Experiential Learning Courses | 50 | 50 | 50 | - | - | 50 | 100 | 200 |
| **Total** | | | | | | | | | | **550** |

**T- Theory , L- Lab , P-Programming, C- Communication**

| Course Code | Department Level Optional Course (DLOC) VI | Specializations |
|---|---|---|
| EC 411 | Intelligent Robotics | Robotics |
| EC 412 | Cyber Security & Digital Forensic | System Security |
| EC 413 | Blockchain Technology | Cloud Computing |
| EC 414 | Analog and Mixed Signal VLSI Design | VLSI Design |

Adm Y 23-24

# Bachelor of Technology

# In

# Electronics & Computer Science

# (Semester III)

Adm Y 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical/Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 201 | Engineering Mathematics III | 03 | - | - | 03 | - | - | 03 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | 1 | 2 | Average | | | | | |
| EC 201 | Engineering Mathematics-III | 40 | 40 | 40 | 60 | - | - | - | 100 |

**Prerequisite:** Engineering Mathematics-I and Engineering Mathematics-2

**Course Objectives:**

1. Learn the Laplace Transform, Inverse Laplace Transform of various functions, its applications.
2. Understand the concept of Fourier Series, its complex form and enhance the problem solving skills.
3. Understand Matrix algebra for engineering problems.
4. Understand the concept of complex variables, C-R equations with applications.
5. Understand the concept of Relation and function.
6. Understand the concept of coding theory

**Course Outcomes:**

After successful completion of the course students will be able to

1. Apply the concept of Laplace transform and its application to solve the real integrals in engineering problems.
2. Expand the periodic function by using the Fourier series for real-life problems and complex engineering problems.
3. Apply the concepts of Eigen values and eigenvectors in engineering problems.
4. Apply complex variable theory, application of harmonic conjugate to get orthogonal trajectories and analytic functions.
5. Apply the concept of relation and function.
6. Use groups and codes in Encoding-Decoding.

**DETAILED THEORY SYLLABUS:**

| Sr. No. | Module | Detailed Content | Hrs. |
|---|---|---|---|
| 1. | **Laplace Transform** | Definition of Laplace transform and Laplace transform of standard functions, Properties of Laplace Transform: Linearity, First Shifting Theorem, change of scale Property, multiplication by t, Division by t, (Properties without proof). Inverse of Laplace Transform by partial fraction and convolution theorem. | 07 |

AcmY 23-24

| | | | |
|---|---|---|---|
| 2. | **Fourier Series , Fourier Transform** | Dirichlet's conditions, Fourier series of periodic functions with period 2π and 2L, Fourier series for even and odd functions, Half range sine and cosine Fourier series, Orthogonal and Ortho-normal functions, Fourier Integral Representation, Fourier Transform and Inverse Fourier transform of constant and exponential function. | 06 |
| 3. | **Linear Algebra Matrix Theory, Quadratic Forms** | Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, Quadratic forms over real field, Linear Transformation of Quadratic form, Reduction of Quadratic form to diagonal form using congruent transformation.<br>Rank, Index and Signature of quadratic form, Sylvester's law of inertia, Value-class of a quadratic form-Definite, Semidefinite and Indefinite.<br>Reduction of Quadratic form to a canonical form using congruent transformations. | 07 |
| 4. | **Complex Variables and conformal mappings** | Function f(z)of complex variable, Introduction to Limit, Continuity and Differentiability of (z), Analytic function: Necessary and sufficient conditions for f(z) to be analytic, Cauchy-Riemann equations in Cartesian coordinates, Milne-Thomson method: Determine analytic function f(z)when real part(u), imaginary part (v) or its combination (u+v / u-v) is given, Conformal mapping, Linear and Bilinear mappings, cross ratio | 06 |
| 5. | **Relation and Function** | Partition of A Set, Relation, Diagram of A Relation, Matrix of A Relation, Digraph of A Relation, Types of Relation, Number of Binary Relations, Number of Reflexive Relations, Equivalance Relation, Relation of the Path, Operations on Relations, Closures, Warshall's Algorithm, | 07 |
| 6. | **Algebraic Structures, coding theory** | Properties of Binary Operations, Semi-Group. Monoid, Group, Ring, Isomorphism, Homomorphism, Group Code, Decoding and Error Correction, Maximum Likelihood Technique | 06 |

**Theory Assessments:**

**1. Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.

**2. End Sem Theory Examination:**

- Question paper will consist of 4 questions, each carrying 20 marks.
- Total 3 questions need to be solved.
- Q.1 will be compulsory, based on the entire syllabus.
- Remaining questions will be randomly selected from all the modules.
- Weightage of marks should be proportional to number of hours assigned to each module.

**Lab Assessment:**

**1. Term work Assessment:**

Term work should consist of all the work done in tutorials and assignments. The final certification and acceptance of term work ensures satisfactory performance throughout in all the assigned work.

**Text Books & References:**


1. Complex Variables and Applications, Brown and Churchill, McGraw-Hill education.
2. Advanced engineering mathematics H.K. Das, S . Chand, Publications.
3. Higher Engineering Mathematics B. V. Ramana, Tata Mc-Graw Hill Publication
4. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Narosa publication
5. Advanced Engineering Mathematics Wylie and Barret, Tata Mc-Graw Hill.
6. Beginning Linear Algebra Seymour Lipschutz Schaum's outline series, Mc-Graw Hill Publication


Aug Y23-24

7. Higher Engineering Mathematics, Dr. B. S. Grewal, Khanna Publication
8. Discrete Mathematical Structures Bernard Kolman, Robert C. Busby ,Sharon Cutler Ross, Nadeem-ur-Rehman, " Pearson Education".
9. Discrete Mathematical Structures: Theory and Applications, D.S. Malik and M.K. Sen: Cengage Learning, 2004.
10. Discrete Mathematics with Applications, Thomas Koshy: Elsevier, 2005, Reprint 2008.

Adm Y 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical/ Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 202 | Analog Electronics Circuits | 03 | 02 | -- | 03 | 01 | -- | 04 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | 1 | 2 | Average | | | | | |
| EC 202 | Analog Electronics Circuits | 40 | 40 | 40 | 60 | - | - | -- | 100 |

**Prerequisite:** Basic Electrical Engineering

**Course Objectives:**

1. To enhance comprehension capabilities of students through understanding of electronic circuits.
2. To perform DC and AC analysis of BJT and MOSFET amplifier circuits.
3. To teach fundamental principles of operational amplifiers.
4. To develop an overall approach for students from selection of integrated circuit, specification, functionality and applications.

**Course Outcomes:**

After successful completion of the course students will be able to

1. Understand construction, characteristics and working of semiconductor devices such as BJT, MOSFET.
2. Derive expressions for performance parameters of BJT and MOSFET based Electronic circuits
3. Select and Design electronic circuits (using BJT and MOSFET) for given specifications
4. Derive and determine various performances-based parameters and their significance for Op-Amp.
5. Analyze and identify the closed loop stability considerations, linear and nonlinear applications of operational amplifiers.
6. Design an application with the use of integrated circuits.

**DETAILED THEORY SYLLABUS:**

| Sr. No. | Module | Detailed Content | Hrs. |
|---|---|---|---|
| 1. | **Semiconductor devices** | 1.1Bipolar Junction Transistor - BJT operations, voltages and current equations, BJT characteristics (CE, CB, CC configurations), early effect.<br>1.2 Field Effect Devices-<br>JFET: Construction, operation and characteristics.<br>MOSFET: Construction, operation and characteristics of D-MOSFET and EMOSFET. | 06 |

Acad Y23-24

| | | | |
|---|---|---|---|
| 2. | **Biasing Circuits of BJTs and MOSFETs** | 2.1 Concept of DC load line, Q point and regions of operations, Analysis and design of biasing circuits for BJT (Voltage divider Bias ONLY)<br>2.2 DC load line and region of operation for MOSFETs. Analysis and design of biasing circuits for E-MOSFET ( voltage divider bias ONLY). | 06 |
| 3. | **Small Signal Amplifiers** | 3.1Concept of AC load line and Amplification, Small signal analysis (Zi, Zo, Av and Ai) of CE amplifiers using hybrid pi model ONLY.<br>3.2 Small signal analysis (Zi, Zo, Av) of CS (for EMOSFET) amplifiers. Introduction to multistage amplifiers. Cascade and cascode only.(Concept, advantages & disadvantages) | 07 |
| 4. | **Operational Amplifiers** | 4.1The ideal operational amplifier (op-amp), internal block diagram of op-amp, characteristics of op-amp, ideal & practical op-amp parameters / specifications (no detailed description or any analysis), mathematical model of op-amp, IC 741 op-amp with pin diagram & description<br>4.2 Operational amplifier open loop & closed loop configurations (theoretical description only), the concept of virtual ground & virtual short | 06 |
| 5. | **Applications of Operational Amplifier** | 5.1 The op-amp inverting amplifier & op-amp non-inverting amplifier (mathematical analysis for derivation of output voltage only,numerical examples & designing)<br>5.2 Adder, summing amplifier, averaging circuit, subtractor, integrator (ideal), differentiator (ideal), op-amp instrumentation amplifier (only mathematical analysis for derivation of output voltage) | 07 |
| 6. | **Special Purpose Integrated Circuits** | 6.1 IC 555 timer internal block diagram & pin configuration, operation in astable & monostable multivibrator with mathematical analysis & numerical examples, design problems on astable & monostable multivibrator, applications in astable & monostable configuration<br>6.2 Functional block diagram, working and design of general purpose IC 723 (HVLC and HVHC).(theoretical description only). working of the switching regulator.<br>(theoretical description only) | 07 |

**Theory Assessments:**

**1. Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.

2. **End Sem Theory Examination:**

- Question paper will consist of 4 questions, each carrying 20 marks.
- Total 3 questions need to be solved.
- Q.1 will be compulsory, based on the entire syllabus.
- Remaining questions will be randomly selected from all the modules.
- Weightage of marks should be proportional to the number of hours assigned to each module.

**Books:**


1. Donald A. Neamen, “Electronic Circuit Analysis and Design”, TATA McGraw Hill, 2nd Edition.
2. Ramakant A. Gayakwad, “Op-Amps and Linear Integrated Circuits”, Pearson Prentice Hall, 4th Edition.


**References:**


1. Robert Boylestad," Electronic Devices and Circuit Theory", Pearson.
2. George Clayton and Steve Winder, “Operational Amplifiers”, NewnesBali, “Linear Integrated Circuits”, Mc Graw Hill


Adm Yr 23-24

3. Gray, Hurst, Lewise, Meyer, “Analysis & Design of Analog Integrated Circuits, Wiley Publications.
4. K. R. Botkar, “Integrated Circuits”, Khanna Publishers (2004)
5. S. Salivahanan, N. Suresh Kumar,“Electronic Devices and Circuits”, Tata McGraw Hill.
6. D. Roy Choudhury and S. B. Jain, “Linear Integrated Circuits”, New Age International Publishers, 4th Edition.
7. Sergio Franco, “Design with operational amplifiers &analog integrated circuits”, Tata McGraw Hill, 3rd edition
8. William D. Stanley, “Operational Amplifiers with Linear Integrated Circuits”, Pearson, 4th Edition

Adm Y 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical/ Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 203 | Digital Circuits & System Design | 03 | 02 | -- | 03 | 01 | -- | 04 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | 1 | 2 | Average | | | | | |
| EC 203 | Digital Circuits & System Design | 40 | 40 | 40 | 60 | - | -- | - | 100 |

**Prerequisite:** Physics of Std 11th, 12th and FE - Basic Electrical & Electronics Engineering

**Course Objectives:**

1. To understand various number systems & codes and to introduce students to various logic gates, SOP, POS form and their minimization techniques.
2. To teach the working of combinational circuits, their applications and implementation of combinational logic circuits using MSI chips.
3. To teach the elements of sequential logic design, analysis and design of sequential circuits.
4. To understand various counters and shift registers and its design using MSI chips.
5. To explain and describe various logic families, their interfacing and Programmable Logic Devices.
6. To train students in writing programs with VHDL hardware description languages.

**Course Outcomes:**

After successful completion of the course students will be able to

1. Perform code conversion and able to apply Boolean algebra for the implementation and minimization of logic functions.
2. Analyze, design and implement Combinational logic circuits.
3. Analyze, design and implement Sequential logic circuits.
4. Design and implement various counter using flip flops and MSI chips.
5. Understand TTL & CMOS logic families, PLDs, CPLD and FPGA.
6. Understand basics of VHDL Hardware Description Language and its programming with combinational and sequential logic circuits.

Adm-X 23-24

**DETAILED THEORY SYLLABUS:**

| Sr. No. | Module | Detailed Content | Hrs. |
|---|---|---|---|
| 1. | **Logic Gates and Boolean Algebra** | Digital logic gates, Realization using NAND, NOR gates, Boolean Algebra, De Morgan's Theorem, SOP and POS representation, K Map up to four variables. | 04 |
| 2. | **Combinational Circuits using basic gates as well as MSI devices** | Arithmetic Circuits: Half adder, Full adder, Ripple carry adder, Carry Look ahead adder, Half Subtractor, Full Subtractor, multiplexer, cascading of Multiplexer, demultiplexer, decoder, Comparator (Multiplexer and demultiplexer gate level upto 4:1). MSI devices: IC7483, IC74151, IC74138, IC7485. | 07 |
| 3. | **Elements of Sequential Logic Design** | Sequential Logic: Latches and Flip-Flops. RS, JK, Master slave flip flops, T & D flip flops with various triggering methods, Conversion of flip flops<br>Counters: Asynchronous, Synchronous Counters, Up Down Counters, Mod Counters, Ring Counter, Twisted ring counter, Shift Registers, Universal Shift Register. | 07 |
| 4. | **Sequential Logic Design** | Sequential Logic Design: Mealy and Moore Machines, Clocked synchronous state machine analysis, State reduction techniques (inspection, partition and implication chart method) and state assignment, sequence detector, Clocked synchronous state machine design.<br>Sequential logic design practices: MSI counters (7490, 7492, 7493,74163, 74169) and applications, MSI Shift registers (74194) and their applications. | 07 |
| 5. | **Logic Families and Programmable Logic Devices** | Logic Families: Types of logic families (TTL and CMOS), characteristic parameters (propagation delays, power dissipation, Noise Margin, Fan-out and Fan-in), transfer characteristics of TTL NAND (Operation of TTL NAND gate),CMOS Logic: CMOS inverter, CMOS NAND and CMOS NOR, Interfacing CMOS to TTL and TTL to CMOS.<br>Programmable Logic Devices: Concepts of PAL and PLA. Simple logic implementation using PAL and PLA, Introduction to CPLD and FPGA architectures. | 07 |
| 6. | **Introduction to VHDL** | Design of Combinational circuits using VHDL: Introduction to Hardware Description Language, Core features of VHDL, data types, concurrent and sequential statements, data flow, behavioral, structural architectures, subprograms, Examples like Adder, subtractor, Multiplexers, De-multiplexers, decoder.<br>Design of Sequential circuits using VHDL: VHDL code for flip flop, counters. | 07 |

AQAD 23-24

**Theory Assessments:**

**1. Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.

**2. End Sem Theory Examination:**

- Question paper will consist of 4 questions, each carrying 20 marks.
- Total 3 questions need to be solved.
- Q.1 will be compulsory, based on the entire syllabus.
- Remaining questions will be randomly selected from all the modules.
- Weightage of marks should be proportional to the number of hours assigned to each module.

**Books:**


1. R. P. Jain, Modern Digital Electronics, Tata McGraw Hill Education, Third Edition 2003.
2. Morris Mano, Digital Design, Pearson Education, Asia 2002.
3. J Bhaskar, VHDL Primer, Prentice Hall, Third Edition (1999 ).


**References:**


1. Digital Logic Applications and Design – John M. Yarbrough, Thomson Publications, 2006
2. John F. Warkerly, Digital Design Principles and Practices, Pearson Education, Fourth Edition, 2008.
3. Stephen Brown and Zvonko Vranesic, Fundamentals of digital logic design with VHDL, McGraw Hill, 2nd Edition.
4. Volnei A. Pedroni, “Circuit Design with VHDL” MIT Press (2004)
5. Digital Circuits and Logic Design – Samuel C. Lee , PHI
6. William I.Flectcher, “An Engineering Approach to Digital Design”, Prentice Hall of India.
7. Parag K Lala, “Digital System design using PLD”, BS Publications, 2003.
8. Charles H. Roth Jr., “Fundamentals of Logic design”, Thomson Learning, 2004.


Adm Y 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical /Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 204 | Data Structures and Algorithms | 03 | 02 | -- | 03 | 01 | -- | 04 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | 1 | 2 | Average | | | | | |
| EC 204 | Data Structures and Algorithms | 40 | 40 | 40 | 60 | 25 | – | 25 | 150 |

**Prerequisite:** C Programming

**Course Objectives:**

1. To teach concept and implementation of linear and nonlinear data structures.
2. To analyze various data structures and select the appropriate one to solve a specific real-world problem.
3. To introduce various techniques for representation of the data in the real world.

**Course Outcomes:**

After successful completion of the course students will be able to

1. Students will be able to implement linear and Non-Linear data structures.
2. Students will be able to handle various operations like searching, insertion, deletion and traversals on various data structures.
3. Students will be able to explain various data structures, related terminologies and its types.
4. Students will be able to choose appropriate data structure and apply it to solve problems in various domains.
5. Students will be able to analyze and Implement appropriate sorting and searching techniques for a given problem.
6. Students will be able to demonstrate the ability to analyze, design, apply and use data structures to solve engineering problems and evaluate their solutions.

Adm Y23-24

**DETAILED THEORY SYLLABUS:**

| Sr. No. | Module | Detailed Content | Hrs. |
|---|---|---|---|
| 1 | **Introduction to Data Structures** | Introduction to Data Structures, Types of Data Structures – Linear and Nonlinear, Operations on Data Structures, Concept of array, Static arrays vs Dynamic Arrays, structures, Array Data Type:- Single and Multidimensional Arrays. Introduction to Analysis of Algorithms, characteristics of algorithms, Time and Space complexities, Asymptotic notations. | 04 |
| 2 | **Stack and Queue** | **Stack:** Basic Stack Operations, Representation of a Stack using Array, Applications of Stack – Well form-ness of Parenthesis, Infix to Postfix Conversion and Postfix Evaluation.<br>**Queue:** Operations on Queue, Array Implementation of Queue, Types of Queue-Circular Queue, Priority Queue, Dequeue, queue-Round Robin Algorithm, Applications of Queue:- Interrupt handling | 07 |
| 3 | **Linked List** | Representation of Linked List, Linked List v*/s* Array, Types of Linked List - Singly Linked List (SLL), Doubly Linked List, Circular Linked List, Operations on Singly Linked List: Insertion, Deletion, reversal of SLL, Print SLL. Implementation of Stack and Queue using Singly Linked List. Singly Linked List Application-Documenting a sequence of heterogeneous records. | 08 |
| 4 | **Tree** | Tree Terminologies, Binary Tree, Types of Binary Tree, Binary Tree Representation: Array and Linked Representation of Binary trees, Binary Tree Traversals algorithms: In-order, Pre-order, Post-order, Binary Search Tree Operations on Binary Search Tree, Applications of Binary Tree - Expression Tree, Huffman Encoding. | 07 |
| 5 | **Graph** | Graph Terminologies, Representation of graph (Adjacency matrix and adjacency list), Graph Traversals – Depth First Search (DFS) and Breadth First Search (BFS), Connected Component, Spanning Trees, Minimum Cost Spanning Trees: Prims and Kruskal's algorithm, Application of Graph – Topological Sorting. | 06 |
| 6 | **Sorting and Searching** | **Searching:** Linear search, Random search, Binary search, Hashing, Applications:- Finding a root of a general quadratic polynomial over a finite interval.<br>**Sorting:** Bubble, Insertion, selection, Quick Sort, Merge Sort, Two Way Merge Sort, Counting sort, Comparison of sorting Techniques based on their complexity, A few practical considerations for in-memory sorting | 07 |

**DETAILED LAB SYLLABUS:**

**Software Requirements:** Turbo C/Code Blocks, Windows/Linux

| Sr. No. | Detailed Lab/Tutorial Description |
|---|---|
| 1 | Program to reverse a list of given numbers using stack ADT. |
| 2 | Program to Check whether parentheses are balanced or not. |
| 3 | Convert an Infix expression to Postfix expression using stack ADT. |
| 4 | Program to evaluate Postfix Expression using Stack ADT. |
| 4 | Program to implement Linear Queue ADT using array. |
| 5 | Program to implement Stack/Queue using linked list. |
| 6 | Program to implement Circular Queue ADT using array. |

Adm. 2024

| | |
|---|---|
| 7 | Program to implement Priority Queue ADT using array. |
| 8 | Program to implement Binary Search Tree ADT using Linked List. |
| 9 | Program to implement searching algorithms -Linear search, Binary search. |
| 10 | Implement Depth First Search and Breadth First Search Graph Traversal technique. |
| 11 | Program to implement sorting algorithms (any 2)- bubble, selection, insertion, merge, quick. |
| 12 | Implementation of Prim's and Kruskal's algorithms for finding out Minimum Cost Spanning Tree of a given input graph. For eg. Finding out electricity distribution cable network with minimum overall cable length. |

**Theory Assessments:**

**1. Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.

**2. End Sem Theory Examination:**

- Question paper will consist of 4 questions, each carrying 20 marks.
- Total 3 questions need to be solved.
- Q.1 will be compulsory, based on the entire syllabus.
- Remaining questions will be randomly selected from all the modules.
- Weightage of marks should be proportional to number of hours assigned to each module.

**Lab Assessment:**

**1. Term work Assessment :**

The experiments should be student centric and attempt to make experiments more meaningful, interesting and innovative. Term work assessment must be based on the overall performance of the student with every experiment and assignments are graded from time to time.

**2. Oral/Viva Assessment:**

The oral examination will be based on the entire syllabus.

**Text Books:**


1. Aaron M Tenenbaum, Yedidyah Langsam, Moshe J Augenstein, "Data Structures Using C", Pearson Publication.
2. Jean Paul Tremblay, P. G. Sorenson, "Introduction to Data Structure and Its Applications", McGraw-Hill Higher Education
3. Thomas H. Cormen, Charles E. Leiserson, Ronald Rivest, Clifford Stein, "Introduction to Algorithms", PHI Learning Pvt. Ltd. (Originally MIT Press); Third edition, 2010
4. Mark A.Weiss, "Data Structures and Algorithm Analysis in C", Pearson Education India; 2nd edition, 2002.
5. Data Structures using C and C++, Rajesh K Shukla, Wiley - India
6. Data Structures Using C, Aaron M Tenenbaum, Yedidyah Langsam, Moshe J Augenstein, Pearson.
7. Data Structures: A Pseudocode Approach with C, Richard F. Gilberg & Behrouz A., Forouzan, Second Edition, CENGAGE Learning.
8. Introduction to Data Structure and Its Applications, Jean Paul Tremblay, P. G. Sorenson.


**Reference Books:**


1. C & Data Structures, Prof. P.S. Deshpande, Prof. O.G. Kakde, DreamTech press
2. E. Balagurusamy, "Data Structure Using C", Tata McGraw-Hill Education India
3. Rajesh K Shukla, "Data Structures using C and C++", Wiley-India


Appr. AY 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical /Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 205 | Database Management System | 03 | 02 | – | 03 | 01 | – | 04 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | 1 | 2 | Average | | | | | |
| EC 205 | Database Management System | 40 | 40 | 40 | 60 | 25 | 25 | -- | 150 |

**Prerequisite:** Data Structures

**Course Objectives:**

1. Develop entity relationship data model and its mapping to relational model
2. Learn relational algebra and Formulate SQL queries.
3. Apply normalization techniques to normalize the database.
4. Understand the concept of transaction, concurrency control and recovery techniques.

**Course Outcomes:** After successful completion of the course students will be able to

1. Recognize the need of database management system
2. Design ER diagram for real life applications.
3. Construct relational models and write relational algebra queries.
4. Formulate SQL queries.
5. Apply the concept of normalization to relational database design.
6. Describe the concept of transaction, concurrency and recovery.

**DETAILED THEORY SYLLABUS:**

| Sr. No. | Module | Detailed Content | Hrs. |
|---|---|---|---|
| 1 | **Introduction Database Concepts** | Introduction, Characteristics of databases, File system v/s Database system, Data abstraction and data Independence, DBMS system architecture, Database Administrator | 04 |

Adm. 23-24

| | | | |
|---|---|---|---|
| 2 | **Entity–Relationship Data Model** | The Entity-Relationship (ER) Model: Entity types: Weak and strong entity sets, Entity sets, Types of Attributes, Relationship constraints: Cardinality and Participation, | 06 |
| 3 | **Relational Model and relational Algebra** | Introduction to the Relational Model, relational schema and concept of keys. Relational Algebra-operators, Relational Algebra Queries. | 07 |
| 4 | **Structured Query Language (SQL)** | Overview of SQL, Data Definition Commands, Integrity constraints: key constraints, Domain Constraints, Referential integrity , check constraints, Data Manipulation commands, Data Control commands, Set and string operations, aggregate functions, group by, having, Views in SQL, joins, Nested and complex queries, Triggers. | 08 |
| 5 | **Relational-Data base Design** | Concept of normalization, Function Dependencies, First Normal Form, 2NF, 3NF, BCNF. | 06 |
| 6 | **Transactions Management and Concurrency and Recovery** | Transaction concept, Transaction states, ACID properties, Transaction Control Commands, Concurrent Executions, Serializability-Conflict and View, Concurrency Control: Lock-based, Timestamp-based protocols, Recovery System: Log based recovery, Deadlock handling. | 07 |

**DETAILED LAB SYLLABUS:**

**Hardware Requirements:** 2GB RAM

**Software Requirements:** SQL server (Oracle/MySQL/PostGreSQL)

| Sr. No. | Detailed Lab/Tutorial Description |
|---|---|
| 1 | Identify the case study and detail statement of the problem. Design an Entity-Relationship(ER) / Extended Entity-Relationship (EER) Model. |
| 2 | Mapping ER/EER to Relational schema model. |
| 3 | Create a database using Data Definition Language (DDL) and apply integrity constraints for the specified System. |
| 4 | Apply DML Commands for the specified system. |
| 5 | Perform Simple queries, string manipulation operations and aggregate functions. |
| 6 | Implement Views and Join operations. |
| **7** | Perform Nested and Complex queries |

Adm Y 23-24

| | |
|---|---|
| 8 | Perform DCL and TCL commands. |
| 9 | Implement function and trigger. |
| 10 | Demonstrate Database connectivity |
| 11 | Implementation and demonstration of Transaction and Concurrency control techniques using locks. |

**Theory Assessments:**

**1. Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.

**2. End Sem Theory Examination:**

- Question paper will consist of 4 questions, each carrying 20 marks.
- Total 3 questions need to be solved.
- Q.1 will be compulsory, based on the entire syllabus.
- Remaining questions will be randomly selected from all the modules.
- Weightage of marks should be proportional to number of hours assigned to each module.

**Lab Assessment:**

**1.Term work Assessment:**

Term work should have min. 8 experiments. Journal must include at least 2 assignments on content of theory and practical of "Database Management System". The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. Total 25 Marks (Experiments: 15-marks, Attendance Theory & Practical: 05-marks, Assignments: 05-marks).

**2.Oral/ Practical Assessment:**

The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. Practical and Oral exam will be based on the entire syllabus.

**Books:**


1. Korth, Slberchatz, Sudarshan, Database System Concepts, 6thEdition, McGraw Hill.
2. Elmasri and Navathe, Fundamentals of Database Systems, 5thEdition, Pearson Education.
3. Raghu Ramkrishnan and Johannes Gehrke, Database Management Systems, TMH.


**References:**


1. Microsoft SQL Server Black Book By Patrick Dalton.
2. https://www.w3schools.com/sql/
3. https://www.postgresqltutorial.com/


Adm Y 23-24

| Course Code | Course Name | Scheme | Theory | Practical | Tutorial | Total |
|---|---|---|---|---|---|---|
| EC 206 | Personal Finance Management | Contact Hours | 2 | - | - | 2 |
| | | Credits | 2 | - | - | 2 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal Assessment | | | End Sem Exam | | | | |
| | | 1 | 2 | Average | | | | | |
| EC 206 | Personal Finance Management | 20 | 20 | 20 | 40 | - | - | -- | 60 |

**Course Objectives**: The course or instructor aims

1. To introduce the basic concepts of finance and their practical application .
2. To demonstrate the process of drafting a financial budget.
3. To explain investment avenues and planning of personal finance.
4. To develop portfolio strategies for individual and institutional investor.
5. To discuss various components of insurance and tax management.
6. To introduce financial frauds , measures to avoid frauds and resources of frauds .

**Course Outcomes**: On successful completion of course learner/student will be able:

1. To know basic concepts of finance and interpret current business positions by reading books of accounts .
2. To analyze investment avenues and plan personal finance to develop portfolio strategies for individuals .
3. To Develop skills to interpret current market position.
4. To Create analytical approach for financial decisions.
5. To learn and understand Tax and Insurance management.
6. To identify financial frauds and understand the level of financial aspects .

Adm Y 23-24

**Detailed Theory Syllabus:**

| Sr. No. | Module | Detailed Contents of Module | Hrs |
|---|---|---|---|
| 1 | Introduction to Personal Financial Planning | Financial Planning Process: Goal, Vision and mission, Components of Personal Financial Plan, Advantages of developing personal financial plan. | 3 |
| 2 | Financial Budget | Meaning and Process of Drafting Financial Budget,Components of Financial Budget, Drafting Financial Budget. | 3 |
| 3 | Investment Management | Meaning of Investment, Concept of Risk and Return and Time Value of Money, Investment Avenues, Portfolio Creation and Management. | 6 |
| 4 | Insurance and Spending Management | Components of Insurance: Life Insurance, Health Insurance, Property Insurance, Spending Management. | 3 |
| 5 | Tax Management | Introduction to Tax Regime and Tax Returns,Introduction to Income Tax and its impact on Incomes ,Tax on property: Revenue and Capital Incomes,Tax Management, Tax Saving, Tax Avoidance | 3 |
| 6 | Financial Frauds | Meaning and Types of Fraud,Investment Frauds, Online Payment Frauds, Identity Theft, Mass Marketing Fraud ,Measures to avoid frauds,Recourse from frauds,Cases of Frauds | 6 |

**Theory Assessment:**

**Internal Assessment: 20 marks**

Consisting of Two compulsory internal assessments 20 Marks each. The final marks will be the average score of both the assessments.

**End Semester Examination: 40 Marks**

Weightage of each module in the end semester examination will be proportional to the number of respective lecture hours mentioned in the curriculum.

**Books and References:**


1. Financial Management: I M Pandey, Vikas Publishing House.
2. Financial Management: M.Y. Khan, P.K. Jain, Tata McGraw Hill.
3. Financial Management: Prassana Chandra, Prentice Hall.
4. Investment Analysis & Portfolio Management- Prasanna Chandra, Tata McGrawHill
5. Wealth Management- Dun & Bradstreet, Tata McGrawHill
6. Wealth Management- S.K .Bagachi, Jaico publishing house


Adm Y 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical/ Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 207 | Human Values and Social Ethics | 02 | -- | -- | 02 | -- | -- | 02 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | 1 | 2 | Average | | | | | |
| EC 206 | Human Values and Social Ethics | -- | -- | -- | -- | 50 | -- | -- | 50 |

**Prerequisite:** Should have respect for justice and be able to reflect on one's personal beliefs and values.

**Course Objectives:**

1. To enable learners to understand the core values that shape the ethical behaviour of a professional.
2. To develop an awareness on the different ethical dilemmas at the work place and society.
3. To inculcate the ethical code of conduct in writing technical article and technology development.
4. To internalize ethical principles and code of conduct of a good human being at home, society and at work place.

**Course Outcomes:**

After successful completion of the course students will be able to

1. Learners will be able to recognize the relation between ethics and values pertinent for an engineering professional.
2. Learners will be able to exercise the responsibility for establishing fair and just processes for participation and group decision making
3. Learners will be able to demonstrate an awareness of self-held beliefs and values and how they are altered in interactions with others.
4. Learners will be able to acquire the writing skills necessary to analyse data from research and attribute the source with proper citation.
5. Learners will be competent to incorporate values and ethical principles in social and professional situations.

**DETAILED THEORY SYLLABUS:**

| Sr. No. | Module | Detailed Content | Hrs. |
|---|---|---|---|
| 1. | **Ethics and Values** | Meaning & Concept of Ethics<br>Difference between Ethics and Values<br>Ethical code of conduct | 03 |

Acad Y23-24

| | | | |
|---|---|---|---|
| 2. | **Professional Ethics** | Professional Ethics vs Personal ethics<br>Components of professional ethics<br>Professional values and its importance | 05 |
| 3. | **Ethics and Society** | Relevance of values and ethics in social work<br>Ethical dilemmas<br>Values and ethical principles of social work<br>● Service<br>● Dignity and worth of a person<br>● Importance of Human relationships<br>● Integrity<br>● Competence<br>● Social Justice | 04 |
| 4. | **Ethics in Technical writing** | Documenting sources<br>Presentation of Information<br>Ethics & Plagiarism | 07 |
| 5. | **Ethics and Technology Development** | Risk management and Individual rights<br>Moral issues in development and application of technology<br>Privacy/confidentiality of information<br>Managing Technology to ensure fair practices | 07 |

**Assessments:**

Termwork : 50 marks (Continuous evaluation)

**Books/References:**


1. Martin Cohen, *101 Ethical Dilemmas* Routledge, 2nd edition, 2007.
2. M. Govindarajan, S. Natarajan & V.S. Senthilkumar, *Professional Ethics and Human Values,* Prentice Hall India Learning Private Limited, 2013.
3. Mike W. Martin, *Ethics in Engineering*, McGraw Hill Education; Fourth edition, 2017.


Adm Y 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical/ Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 208 | Analog & Digital Electronics Lab | | 2 | -- | - | 1 | -- | 1 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment (Review) | | | End Sem. Exam | | | | |
| | | 1(10) | 2(10) | Average | | | | | |
| EC 208 | Analog & Digital Electronics Lab | - | - | - | - | 25 | – | 25 | 50 |

**Course Objectives:**

1. To Enhance students' understanding of electronic circuits.
2. To Perform DC and AC analysis of BJT and MOSFET amplifiers.
3. To Learn operational amplifier principles and applications.
4. To Develop skills in IC selection, functionality, and application.
5. To Explain combinational and sequential circuit design using MSI chips.
6. To Introduce logic families, PLDs, and VHDL programming.

**Course Outcomes:**

After successful completion of the course students will be able to

1. Understand construction, characteristics and working of semiconductor devices such as BJT, MOSFET
2. Derive expressions for performance parameters of BJT and MOSFET based Electronic circuits.
3. Derive and determine various performances-based parameters and their significance for Op-Amp and analyze and identify the linear and nonlinear applications of operational amplifiers.
4. Design an application with the use of integrated circuits.
5. Analyze, design and implement Combinational logic circuits, Sequential logic circuits and implementation of various counters using flip flops and MSI chips.
6. Understand basics of VHDL Hardware Description Language and its programming with combinational and sequential logic circuits.

Admy 23-24

**DETAILED LAB SYLLABUS:**

**Software Requirements for AEC :** LTSpice

**Hardware Requirements for AEC:** Breadboard, Transistors, Resistors, Diodes, Connecting wires,Op-amp IC 741, timer IC555

**Software Requirements for DCSD:** VHDL simulation software

**Hardware Requirements for DCSD:** Hardware Kits

| Sr. No. | Detailed Lab/Tutorial Description |
|---|---|
| 1 | To study input and output characteristics of CE configuration |
| 2 | Analyze Integrator using op-amp IC 741 |
| 3 | Design Monostable Multivibrator using IC 555. |
| 4 | To perform DC analysis of voltage divider bias for (BJT) CE amplifier. |
| 5 | To study BJT as CE amplifier.and calculate its voltage gain |
| 6 | Design inverting, non-inverting amplifier and buffer using IC 741 |
| 7 | Design Wein bridge and RC phase shift Oscillator using op-amp IC 741 |
| 8 | Simulation experiment on drain and transfer characteristics of JFET |
| 9 | Simulation experiment on multistage amplifier. |
| 10 | Design High Voltage High Current voltage regulator using IC 723. |
| 11 | Study and design of Combinational circuits. |
| 12 | Study and design of sequential circuits |
| 13 | Implementation of Asynchronous counter using MSI counter IC and flip flops |
| 14 | Implementation of synchronous counter using MSI counter IC and flip flops |
| 15 | VHDL program for Combinational circuits |
| 16 | VHDL program for sequential circuits |

**Lab Assessment:**

Adm Y 23-24

**Term work Assessment :**

At least 8 experiments covering the entire syllabus of AEC and DCSD should be set to have well predefined inference and conclusion. Simulation experiments are also encouraged. The experiments should be student centric and attempt to make experiments more meaningful, interesting and innovative. Term work assessment must be based on the overall performance of the student with every experiment and assignments are graded from time to time.

**Practical/Viva Assessment:**
The practical and oral examination will be based on the entire syllabus.(10 marks for performance and 15 marks for oral)

Adm Y 23-24

# Bachelor of Technology

# In

# Electronics & Computer Science

# (Semester IV)

Adm Y 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical /Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 209 | Engineering Mathematics IV | 03 | -- | - | 03 | -- | - | 03 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | 1 | 2 | Average | | | | | |
| EC 209 | Engineering Mathematics IV | 40 | 40 | 40 | 60 | - | -- | -- | 100 |

**Prerequisite:** Engineering Mathematics I, Engineering Mathematics II and Engineering Mathematics III.

**Course Objectives:**

1. Understand the basic techniques of statistics like correlation, regression, and curve fitting for data analysis, Machine learning, and AI.
2. Acquaint with the concepts of probability, random variables with their distributions and expectations.
3. Understand the concepts of vector spaces used in the field of machine learning and engineering problems.
4. Introduce students to equivalence relations, recurrence relations, Introduce students to graphs, and trees.
5. Understand the concepts of complex integration.
6. Use concepts of vector calculus to analyze and model engineering problems.

**Course Outcomes:**

After successful completion of the course students will be able to

1. Apply the concept of Correlation and Regression to the engineering problems in data science, machine learning, and AI.
2. Illustrate understanding of the concepts of probability and expectation for getting the spread of the data and distribution of probabilities.
3. Apply the concept of vector spaces and orthogonalization process in Engineering Problems.
4. Express recursive functions of other subjects like Data Structures as recurrence relation, Ability to understand use of functions, graphs and trees in programming applications.
5. Use the concepts of Complex Integration for evaluating integrals, computing residues & evaluate various contour integrals.
6. Apply the concepts of vector calculus in real life problems.

Adm Y 23-24

**DETAILED THEORY SYLLABUS:**

| Sr. No. | Module | Detailed Content | Hrs. |
|---|---|---|---|
| 1 | **Correlation, Regression and Curve Fitting,** | Karl Pearson's Coefficient of correlation (r),Spearman's Rank correlation coefficient (R) ,Lines of regression , Fitting of first and second degree curves. | 06 |
| 2 | **Probability, Probability Distributions** | Conditional probability, Total Probability and Baye's Theorem, Discrete and Continuous random variables, Probability mass and density function, Probability distribution for random variables, Expectation, Variance, Binomial distribution ,Poisson distribution, Normal distribution | 06 |
| 3 | **Linear Algebra : Vector Spaces** | Vectors in R^n , norm, dot product, The Cauchy Schwarz inequality, Unit vector ; Linear combinations, linear Dependence and Independence, QR decomposition ; Orthogonal projection, Orthonormal basis, Gram-Schmidt process for vectors ; Vector spaces over real field $R^n$ to $R^m$. | 06 |
| 4 | **Graphs and Trees** | Types of Graphs, Isomorphism Of Graphs, Subgraphs, Types of Graphs, Complement of Graph, Connected Graphs, Eulerian And Hamiltonian Graphs, Trees, Binary Trees, Minimum Spanning Tree, Kruskal's Algorithm | 07 |
| 5 | **Lattice Theory & Recurrence relation** | Poset, Hasse Diagram, Lattices, Special Types of Lattices, Solving Recurrence relation, Linear Homogenous Recurrence relation with constant coefficients, Introduction to Non-Homogenous Recurrence relation | 06 |
| 6 | **Complex Integration and Vector Integration** | Line Integral, Cauchy's Integral theorem for simple connected regions (without proof), Cauchy's Integral formula (without proof).<br>Taylor's and Laurent's series (without proof).<br>Definition of Singularity, Zeroes, poles of f(z), Residues, Cauchy's Residue Theorem (without proof)<br>Vector integral: Line Integral, Green's theorem in a plane (Without Proof),<br>Stokes' theorem (Without Proof) only evaluation. Gauss' divergence theorem (Without Proof) | 08 |

Adm 2023-24

**Theory Assessments:**

1. **Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.

**2. End Sem Theory Examination:**

- Question paper will consist of 4 questions, each carrying 20 marks.
- Total 3 questions need to be solved.
- Q.1 will be compulsory, based on the entire syllabus.
- Remaining questions will be randomly selected from all the modules.

Weightage of marks should be proportional to the number of hours assigned to each module.

**Books/References:**


1. Probability, Statistics and Random Processes, T. Veerarajan, Mc. Graw Hill education.
2. Vector Analysis, Murray R. Spiegel, Schaum Series.
3. Beginning Linear Algebra Seymour Lipschutz Schaum's outline series, Mc-Graw Hill Publication.
4. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Narosa publication.
5. Discrete Mathematical Structures"Bernard Kolman, Robert C. Busby ,Sharon Cutler Ross, Nadeem-ur-Rehman, " Pearson Education.
6. Discrete Mathematical Structures: Theory and Applications, D.S. Malik and M.K. Sen: Cengage Learning, 2004.
7. Higher Engineering Mathematics B. V. Ramana, Tata Mc-Graw Hill Publication.
8. Advanced Engineering Mathematics Wylie and Barret, Tata Mc-Graw Hill.
9. Advanced engineering mathematics H.K. Das, S . Chand, Publications.
10. Discrete Mathematics with Applications, Thomas Koshy, Elsevier, 2005, Reprint 2008.


Adm AY 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical/Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 210 | Analysis of Algorithms | 03 | 02 | – | 03 | 01 | – | 04 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | 1 | 2 | Average | | | | | |
| EC 210 | Analysis of Algorithms | 40 | 40 | 40 | 60 | 25 | 25 | -- | 150 |

**Prerequisite:** Data Structure

**Course Objectives:**

1. To conceptualize learners with mathematical models for analysis of algorithm
2. To understand and solve problems using various algorithmic design strategies.
3. To apply algorithm strategies to real life problems.

**Course Outcomes:**

After successful completion of the course students will be able to

1. Understand notations used for time complexity analysis of algorithms.
2. Explain Divide and Conquer Approach with its applications.
3. Understand Dynamic Programming Approach for finding the shortest path.
4. Apply the concept of Greedy Method Approach with different applications.
5. Use Backtracking and Branch-and-bound Method for various applications.
6. Understand the concept of Number Theoretic, Graph Theoretic and Non-deterministic polynomial time algorithms

AY 23-24

**DETAILED THEORY SYLLABUS:**

| Sr. No. | Module | Detailed Content | Hrs. |
|---|---|---|---|
| 1 | **Introduction to algorithms and analysis of algorithm** | Brief introduction of Algorithms and its design methods. Analysis of Algorithm - Time & Space Complexity, Asymptotic Analysis in best, average and worst case & Asymptotic Notations (O, Ω, θ, w, o ). Brief introduction of Randomized Algorithms. | 07 |
| 2 | **Divide and Conquer Approach** | Recurrence Equations, Solution of Recurrence equations - Master Theorem, Recurrence Tree method & Substitution method.<br>General Structure of a Divide and Conquer Algorithm, Applications - Analysis of Merge & Quick sort Algorithms. Strassen's Matrix Multiplication Algorithm & Finding the closest pair of points in a 2D plane Algorithm. | 06 |
| 3 | **Dynamic Programming Approach** | General Method, Applications - Matrix chain multiplication, Optimal binary search trees, Single Source Shortest Path - Bellman-Ford Algorithm, Dijkstra's algorithm. All pairs shortest path problem - Floyd-Warshall Algorithm, Travelling salesperson problem. | 08 |
| 4 | **Greedy Method Approach** | General Method, Applications - Job sequencing with deadlines, fractional & 0/1 knapsack problem, Minimum cost spanning trees - Prims & Kruskal's Algorithms. | 08 |
| 5 | **Backtracking and Branch-and-bound** | Backtracking - General Method, Graph coloring.<br>Branch and Bound - General Method, Applications - 0/1 knapsack problem - LC Branch and Bound solution, FIFO Branch and Bound solution. | 05 |
| 6 | **Selected algorithms and Non-deterministic polynomial time algorithms** | Number Theoretic - Euclid's algorithm for GCD and it's time complexity analysis,<br>Graph Theoretic - Johnson's algorithm for All pair Shortest Path problem<br>Computational Complexity classification of problem: Brief introduction of non deterministic algorithms, Complexity classes - P, NP. | 05 |

**DETAILED LAB SYLLABUS:**

**Lab Prerequisite:**

**Software Requirements: C/Python/C++**

| Sr. No. | Detailed Lab/Tutorial Description |
|---|---|
| 1 | Implement Merge and Quick sort algorithms. |
| 2 | Implement Bellman-Ford algorithm. |
| 3 | Implement Floyd-Warshall algorithm. |
| 4 | Implement Dijkstra's algorithm for the single source shortest path problem on a given weighted graph. |
| 5 | Implement Prim/Kruskal algorithm for finding a minimum cost spanning tree of a given input graph. |
| 6 | Implement a backtracking based algorithm for vertex coloring of a given graph. |
| **7** | Implement Johnson's algorithm for shortest paths, for a given graph. |
| 8 | Implement a randomized algorithm for searching an element in an unsorted array and derive its expected time complexity. |
| 9 | Implement Euclid's algorithm to calculate GCD of a given set of n>2 natural numbers. |

**Theory Assessments:**

**1. Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.

**2. End Sem Theory Examination:**

- Question paper will consist of 4 questions, each carrying 20 marks.
- Total 3 questions need to be solved.
- Q.1 will be compulsory, based on the entire syllabus.
- Remaining questions will be randomly selected from all the modules.

Weightage of marks should be proportional to number of hours assigned to each module.

**Lab Assessment:**

**1.Termwork Assessment:**

Term work should consist of all the work done in tutorials and assignments. The final certification and acceptance of term work ensures satisfactory performance throughout all the assigned work.

**2. Oral/Practical Assessment:** Practical & Oral Exams should be conducted based on syllabus and practicals conducted.

**Text Books:**

Adm Y 23-24

1. Ellis Horowitz,Satraj Sahni and Rajasekharam, Fundamentals of Computer Algorithms, Galgotia publications pvt. Ltd.
2. Parag Himanshu Dave, Himanshu Bhalchandra Dave, Design and Analysis Algorithms - Publisher: Pearson

**Reference Books:**


1. T.H.Cormen, C.E.Leiserson, R.L.Rivest, C. Stein, Introduction to Algorithms, 2nd edition, Prentice-Hall India, 2001.
2. J. Kleinberg and E. Tardos, Algorithm Design, Pearson International Edition, 2005.


Adm Y 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical/ Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 211 | Basics of VLSI Design | 03 | 02 | -- | 03 | 01 | -- | 04 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | 1 | 2 | Average | | | | | |
| EC 211 | Basics of VLSI Design | 40 | 40 | 40 | 60 | 25 | -- | 25 | 150 |

**Course Objectives:**

1. To teach fundamental principles of VLSI circuit design and layout techniques.
2. To highlight the circuit design issues in the context of VLSI technology.
3. To explain different scaling effects.
4. To study CMOS gates and effect of W/L ratio.
5. To study dynamic gates and circuit realization using pass transistors.
6. To design semiconductor memories and its importance.

**Course Outcomes: Upon successful completion of the course students will be able to**

1. Apply the knowledge to demonstrate a clear understanding of choice of technology and technology scaling.
2. Explain the design of MOSFET Inverters.
3. Analyze and design MOS based circuits design styles.
4. Understand CMOS gates and effect of W/L ratio.
5. Understand dynamic gates and circuit realization using pass transistors.
6. Understand the design of Semiconductor Memories.

**Prerequisite:** Analog Electronics Circuits, Digital Circuits and System Design(DCSD)

Adm Y 23-24

**DETAILED THEORY SYLLABUS:**

| Sr. No. | Module | Detailed Content | Hrs |
|---|---|---|---|
| 1 | **Technology Comparison, MOSFET Scaling** | Comparison of BJT, NMOS and CMOS technology<br>Types of scaling, MOSFET Models, MOSFET capacitances | 05 |
| 2 | **MOSFET Inverters** | **Circuit Analysis:** Static and dynamic analysis (Noise, propagation delay and power dissipation) of resistive load, E mode MOSFET load, D mode MOSFET load inverter and CMOS inverter, comparison of all types of MOS inverters, design of CMOS inverters | 07 |
| 3 | **Universal gates, Complex circuits using MOSFETs** | **Logic Circuit Design**: Analysis and design of 2-I/P NAND and NOR using equivalent CMOS inverter, W/L ratio, Complex circuits. | 07 |
| 4 | **MOS Circuit Design Styles** | **Design Styles:** Static CMOS, pass transistor logic, transmission gate, Pseudo NMOS, Domino, NORA, Zipper, C2MOS, sizing using logical effort | 08 |
| 5 | **Circuit Realization using MOSFETs** | **Circuit Realization:** SR Latch, JK FF, D FF, 1 Bit Shift Register, MUX, decoder using above design styles | 06 |
| 6 | **Semiconductor Memories** | **SRAM:** ROM Array, SRAM (operation, design strategy, leakage currents, read/write circuits), DRAM (Operation, leakage currents, refresh operation), Flash memory- NOR flash, NAND flash. | 06 |

**DETAILED LAB SYLLABUS:**

**Software Requirements:** TINA**,** NGSpice, Microwind

| Sr. No. | Detailed Lab Description |
|---|---|
| 1 | Effect of parasitic capacitance and threshold voltage on output of NMOS inverter with resistive load. |
| 2 | Circuit characteristics and performance estimation of NMOS inverter with resistive load.<br>1) Verification of $V_{OH}$ level for different values of load resistance. |

Adm Y23-24

| | |
|---|---|
| | 2) Find rise time for different values of load resistance. |
| 3 | Circuit characteristics and performance estimation of NMOS inverter with Enhancement mode MOSFET load. |
| 4 | Circuit characteristics and performance estimation of NMOS inverter with Depletion mode N channel MOSFET as a load. |
| 5 | Circuit characteristics and performance estimation of CMOS inverter.<br>1) Verification of $V_{OH}$ and $V_{OL}$ levels.<br>2) Comparison of rise and fall times for different values of W/L ratio of pull up and pull down devices. |
| 6 | Circuit characteristics and performance estimation of CMOS Dynamic 2 Input NAND Gate.<br>1) Verification of $V_{OH}$ and $V_{OL}$ levels for various input possibilities.<br>2) Verification of precharge and evaluate condition for different inputs.<br>3) Verification of charge leakage problem. |
| **7** | Design of 4:1 MUX using pass transistor logic and transmission gates. |
| 8 | Design of 6T SRAM using Microwind dsch3.1. |

**Theory Assessments:**

1. **Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.
2. **End Sem Theory Examination:**

- Question paper will consist of 4 questions, each carrying 20 marks.
- Total 3 questions need to be solved.
- Q.1 will be compulsory, based on the entire syllabus.
- Remaining questions will be randomly selected from all the modules.

Weightage of marks should be proportional to number of hours assigned to each module.

**Lab Assessments:**

Term work should consist of 8 experiments.

Journal must include at least 3 assignments.

Adm Y23-24

**Term work Assessment:**

Total 25 Marks (Experiments: 10-marks, Assignments: 10-marks, Attendance Theory & Practical: 05-marks)

**Oral/Viva Assessment**:

Based on the above contents and entire syllabus.

**Text Books:**


1. Sung-Mo Kang and Yusuf Leblebici, "CMOS Digital Integrated Circuits Analysis and Design", Tata McGraw Hill, 3rd Edition.
2. Jan M. Rabaey, Anantha Chandrakasan and Borivoje Nikolic, "Digital Integrated Circuits: A Design Perspective", Pearson Education, 2nd Edition.


**References**


1. Etienne Sicard and Sonia Delmas Bendhia, "Basics of CMOS Cell Design", Tata McGraw Hill, First Edition. 2. Neil H. E. Weste, David Harris and Ayan Banerjee, "CMOS VLSI Design: A Circuits and Systems Perspective", Pearson Education, 3rd Edition.

2. Debaprasad Das, "VLSI Design", Oxford, 1st Edition. 6. Kaushik Roy and Sharat C. Prasad, "Low-Power CMOS VLSI Circuit Design", Wiley, Student Edition.


Adm Y 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical/Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 212 | System Software & Operating Systems | 03 | -- | -- | 03 | -- | -- | 03 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | 1 | 2 | Average | | | | | |
| EC 212 | System Software & Operating Systems | 40 | 40 | 40 | 60 | -- | -- | -- | 100 |

**Prerequisite:** Basic knowledge of Data structures and Computer architecture, Any programming language

**Course Objectives:**

1. To understand the role and functioning of various system programs over application programs.
2. To understand basic concepts and designing of assembler and Macro processor.
3. To understand the role of loaders, linkers and Compilers.
4. To introduce basic concepts and functions of operating systems.
5. To introduce the concept of a process, thread and its management, Inter-process communication (IPC) and also understand the concepts of process synchronization and deadlock.
6. To understand the concepts and implementation of memory management policies, virtual memory and functions of Operating Systems for device management.

**Course Outcomes:**

After successful completion of the course students will be able to

1. Identify the relevance of different system programs.
2. Explain various data structures used for assembler and macro processor design.
3. Understand the functions of linkers, loaders and fundamentals of compiler design also identify the relationships among different phases of the compiler.
4. Understand the objectives, functions and structure of OS.
5. Analyze the concept of process management and evaluate performance of process scheduling algorithms.
6. Apply and analyze different techniques of memory management and I/O management.

AGE Y 23-24

**DETAILED THEORY SYLLABUS:**

| Sr. No. | Module | Detailed Content | Hrs. |
|---|---|---|---|
| 1 | **Introduction to System Software** | Concept of System Software, Introduction to various system programs such as Assembler, Macro processor, Loader, Linker, Compiler, Interpreter, Device Drivers, Operating system, Editors, Debuggers. | 03 |
| 2 | **Assemblers and Macro Processors** | Elements of Assembly Language programming, Assembler Design: Introduction to single pass Assembler Design for Hypothetical machines, data structures used.<br>Macro definition and call, parameterized, conditional Macro, Design of Two pass macro processor for Hypothetical machines, data structures used. | 08 |
| 3 | **Linkers, Loaders and Compilers** | Functions of loaders, Absolute loader/Compile and Go loader, Phases of compilers:Lexical Analysis, Syntax analysis, SR Parser, Introduction to semantic analysis, Intermediate Code Generation:Types of Intermediate codes, Code optimization techniques, Introduction to Code Generation. | 08 |
| 4 | **Overview of operating System** | Introduction, Objectives, Functions and Types of Operating System, Operating System Services and Interface; Operating system structures: Layered, Monolithic and Microkernel. | 04 |
| 5 | **Process Management** | Concept of a Process, Process States, Operation on Process Uniprocessor Scheduling-Types: Preemptive and Non-preemptive, scheduling algorithms Threads: Definition and Types, Concept of Multithreading,<br>Inter-Process Communication, Process Synchronization, Mutual Exclusion: ,Semaphores, Producer Consumer problem, Principles of Deadlock: Conditions Deadlock Handling Mechanism. | 08 |
| 6 | **Memory Management and I/O Management** | Basic Concepts of Memory Management; Memory Allocation Techniques, Paging, TLB, Segmentation, Virtual Memory; Demand Paging, Page Replacement Algorithms,<br>I/O Devices, Disk Scheduling algorithm: FCFS, SSTF, SCAN, CSCAN, LOOK, C- LOOK, Linux I/O. | 08 |

**Theory Assessments:**

1. **Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.

AcadY23-24

2. **End Sem Theory Examination:**

- Question paper will consist of 4 questions, each carrying 20 marks.
- Total 3 questions need to be solved.
- Q.1 will be compulsory, based on the entire syllabus.
- Remaining questions will be randomly selected from all the modules.

Weightage of marks should be proportional to the number of hours assigned to each module.

**Text Books:**

1. D. M Dhamdhere: Systems programming, Tata McGraw Hill.

2. A. V. Aho, R. Shethi, Monica Lam , J.D. Ulman : Compilers Principles, Techniques and Tools, Pearson Education , Second Edition.

3. William Stallings, Operating System: Internals and Design Principles, Prentice Hall, 8th Edition, 2014, ISBN-10: 0133805913 鈥?ISBN-13: 9780133805918 .

4. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, John Wiley & Sons , Inc., 9th Edition, 2016, ISBN 978-81-265-5427-0

**References:**

1. Compiler construction : principles and practices , Kenneth C.Louden ,CENGAGE Learning.
2. System software : An introduction to system programming , Leland L. Beck, Pearson.
3. Principles of Operating Systems, Naresh Chauhan, First Edition , Oxford university press.
4. Achyut Godbole and Atul Kahate, Operating Systems, McGraw Hill Education, 3rd Edition.

Adm Y 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical /Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 213 | Microprocessor & Microcontrollers | 03 | 02 | -- | 03 | 01 | -- | 04 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | 1 | 2 | Average | | | | | |
| EC 213 | Microprocessor & Microcontrollers | 40 | 40 | 40 | 60 | 25 | - | 25 | 150 |

**Prerequisite:** Digital System Design

**Course Objectives:**

1. To understand the basic concepts of Microprocessor based systems.
2. To understand the architecture and instruction set of 8-bit Microcontroller 8051.
3. To write assembly / C programs for 8051 Microcontroller.
4. To understand peripheral devices and their interfacing with 8051 Microcontroller.
5. To understand various applications of 8051microcontroller.
6. To understand architecture of 32-bit Microcontroller ARM Cortex M3.

**Course Outcomes:**

After successful completion of the course students will be able to

1. Identify the features of microcontrollers (8051 & ARM Cortex M3)
2. Understand the architecture and aspects of 8051& Cortex M3 microcontroller.
3. Interface microcontroller with hardware for given application
4. Write and execute assembly or C language programs for given application.
5. Explain the Interrupt system, operation of Timers/Counters and Serial port of 8051
6. Develop small microcontroller based applications.

**DETAILED THEORY SYLLABUS:**

| Sr. No. | Module | Detailed Content | Hrs. |
|---|---|---|---|
| 1. | **Introduction to Microprocessor System.** | 1.1 Microprocessor based system: CPU, I/O Devices, Clock, Memory, Concept of Address, Data and Control Bus.<br>1.2 Features of 8086 Microprocessor.<br>1.3 Comparison between Microprocessor and Microcontroller.<br>1.4 Concept of Harvard & Von Neumann Architecture.<br>1.5 pipelined operation. | 04 |

AY 23-24

| | | | |
|---|---|---|---|
| 2 | **8051 Microcontroller Architecture** | 2.1 8051 Features & its architecture (ALU, PC, DPTR, PSW, Internal RAM, Internal ROM, Latch, SFRs, General purpose registers, Timer/Counter, Interrupt, Ports).<br>2.2 Pin configuration of 8051 Microcontroller.<br>2.3 Memory organization (Program and Data memory Map) | 04 |
| 3. | **8051 Microcontroller assembly language programming** | 3.1 Addressing modes of 8051.<br>3.2 Assembler directives of 8051.<br>3.3 Instruction Set: Data transfer, Arithmetic, Logical, Branching.<br>3.4 Programming concepts: Looping , Counting, sorting and Indexing, Data manipulation, Masking.<br>3.5 Programs related to: arithmetic, logical, Branch & delay. | 08 |
| 4. | **Internal Hardware of 8051 Microcontroller & Programming** | 4.1 I/O port structure and programming.<br>4.2 Timer/Counter and programming..<br>4.3 Serial port and programming.<br>4.4 Interrupts and programming.<br>4.5 Power saving modes of 8051: Power down and idle mode. | 08 |
| 5. | **8051 Interfacing & Applications** | 6.1 Display interfacing: 7-segment LED display, 16x2 generic alphanumeric LCD display.<br>6.2 Analog devices interfacing: 8-bit ADC and DAC<br>6.3 Motor interfacing: Dc motor & Stepper motor.<br>6.4 Waveform (Ramp, triangular & Sine wave) generation program using DAC. | 08 |
| 6. | **Advanced Microcontroller Architecture (ARM CORTEX-M3)** | 6.1 Comparison of CISC & RISC architectures.<br>6.2 Overview of ARM family.<br>6.3 ARM Cortex-M3 architecture,.<br>6.4 Programmer's model: Operation Modes and States, registers, special registers, Application Program Status Register- Integer status flags, Q status flag, GE bits.<br>6.5 Memory system: Features and memory map<br>6.6 Exceptions and Interrupts - Nested vectored interrupt controller. | 07 |

**DETAILED LAB SYLLABUS:**

**Lab Prerequisite:** Digital System Design

**Hardware Requirements:** Experiments can be conducted on Assembler, Emulator

**Software Requirements:** Hardware kits

| Sr. No. | Detailed Lab/Tutorial Description |
|---|---|
| 1 | Introduction to 8086 microprocessor kit and assembler. |
| 2 | To write an assembly language program to perform Arithmetic and Logical Operations using 8051 microcontroller. |
| 3 | To write an assembly language program to transfer of data bytes between Internal and External Memory using 8051 microcontroller. |

AY 23-24

| | |
|---|---|
| 4 | To write an assembly language program to perform experiments based on General Purpose Input-Output & Timers. |
| 5 | Program for Serial communication of 8051 using UART. |
| 6 | Programs for Interfacing of Stepper Motor/DC motor with 8051 microcontroller. |
| 7 | Programs for generating waveform (Square, Triangular, Sine wave) with 8051 microcontroller. |
| 8 | Programs for Interfacing of LCD with 8051 |
| 9 | Mini project based on any application related to 8051 microcontroller. |

**Theory Assessments:**

**1. Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.

**2. End Sem Theory Examination:**

- Question paper will consist of 4 questions, each carrying 20 marks.
- Total 3 questions need to be solved.
- Q.1 will be compulsory, based on the entire syllabus.
- Remaining questions will be randomly selected from all the modules.
- Weightage of marks should be proportional to the number of hours assigned to each module.

**Lab Assessment:**

**1. Term work Assessment:**

08 Experiments covering the entire syllabus must be given during the "Laboratory session batch wise". Computation/simulation based experiments are also encouraged. The experiments should be student centric and attempts should be made to make experiments more meaningful, interesting and innovative. Application oriented one mini-project can be conducted for a maximum batch of at least 04 students.

**Text Books:**


1. Microprocessor and Interfacing: By Douglas Hall (TMH Publication)
2. M. A. Mazidi, J. G. Mazidi and R. D. Mckinlay, "The 8051 Microcontroller & Embedded systems", Pearson Publications, Second Edition 2006.
3. C. Kenneth J. Ayala and D. V. Gadre, "The 8051 Microcontroller & Embedded system using assembly & 'C' ", Cengage Learning, Edition 2010.
4. Joseph Yiu,"The Definitive Guide to ARM CORTEX-M3 & CORTEX-M4 Processors", Elsevier, 2014, 3rd Edition.


**Reference Books:**


1. 8086 Microprocessor Programming and Interfacing the PC: By Kenneth Ayala (West Publication).
2. Microcomputer Systems: 8086/8088 family Architecture, Programming and Design: By Liu & Gibson (PHI Publication).
3. Satish Shah, "The 8051 Microcontrollers", Oxford publication first edition 2010.
4. "MCS@51 Microcontroller, Family users Manual" Intel.
5. David Seal, "ARM Architecture", Reference Manual (2nd Edition), Publisher Addison Wesley.


ARM Y23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical /Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 214 | Entrepreneurship | 02 | - | - | 02 | - | - | 02 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | 1 | 2 | Avg. of 2 | | | | | |
| EC 214 | Entrepreneurship | 20 | 20 | 20 | 40 | - | - | - | 60 |

**Course Objectives**:

1. To understand the basic concepts of entrepreneurship.
2. To understand the role of entrepreneurship in economic development
3. To understand the importance of opportunity recognition and internal and external analyses to the success of a business venture
4. To enable the learners to know the factors contributed in failure of the enterprise

**Course Outcomes**:

1. Analyse the business environment in order to identify business opportunities
2. Identify the elements of success of entrepreneurial ventures
3. Evaluate the effectiveness of different entrepreneurial strategies,
4. Interpret their own business plan
5. Identify and understand marketing plan and strategies
6. Identify the causes of entrepreneurial failure

Adm Y 23-24

**Detailed Theory Syllabus:**

| Module No | Detailed Content | Hours |
|---|---|---|
| 1 | Conceptual definition of entrepreneurs and entrepreneurship, Advantages and Disadvantages of Being an Entrepreneur, Entrepreneurial motivation, Entrepreneurial characteristics | 8 |
| 2 | Recognizing, assessment and Exploiting the Opportunity, Conducting Internal and External Analyses, Determining the Feasibility of the Concept, Selecting a Marketing Strategy | 6 |
| 3 | Entrepreneurial Business Types<br>A. Overview of Franchising and Their Advantages and Disadvantages<br>B. Overview of Buyouts & Their Advantages and Disadvantages<br>C. Overview of Family Businesses and Their Advantages and Disadvantages | 6 |
| 4 | The Overall Business Plan, Purpose of the Business Plan, Components of the Business Plan, Presentation of the Business Plan, Matching the Business Plan to the Needs of the Firm | 6 |
| 5 | The Marketing Plan, conducting a Market Analysis, Understanding the Target Market, Reaching the Target Market through Locale and Engagement | 8 |
| 6 | Entrepreneurial failure, early stage failure, late stage failure | 6 |

**Assessment:**
Internal Assessment:20 marks

End Semester Examination: 40 Marks

**Books and References:**


1. Fundamentals of Entrepreneurship by H. Nandan, PHI
2. Entrepreneurship by Robert Hisrich, Michael Peters, Dean Shepherd, Sabyasachi Sinha, Mc Graw Hill
3. Why startups fail: A new roadmap for entrepreneurial success by Tom Eisenmann


Adm Y 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical/Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 215 | System Software & Operating Systems Lab | - | 02 | -- | - | 01 | -- | 01 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | 1 | 2 | Average | | | | | |
| EC 215 | System Software & Operating Systems Lab | - | - | - | - | 25 | -- | 25 | 50 |

**Prerequisite:** Basic knowledge of Data structures and Computer architecture, Any programming language

**Course Objectives:**

1. To understand the role and functioning of various system programs over application programs.
2. To understand basic concepts and designing of assembler and Macro processor.
3. To understand the role of loaders, linkers and Compilers.
4. To introduce basic concepts and functions of operating systems.
5. To introduce the concept of a process, thread and its management, Inter-process communication (IPC) and also understand the concepts of process synchronization and deadlock.
6. To understand the concepts and implementation of memory management policies, virtual memory and functions of Operating Systems for device management.

**Course Outcomes:**

After successful completion of the course students will be able to

1. Identify the relevance of different system programs.
2. Explain various data structures used for assembler and macro processor design.
3. Understand the functions of linkers, loaders and fundamentals of compiler design also identify the relationships among different phases of the compiler.
4. Understand the objectives, functions and structure of OS.

AY 23-24

5. Analyze the concept of process management and evaluate performance of process scheduling algorithms.
6. Apply and analyze different techniques of memory management and I/O management.

**DETAILED LAB SYLLABUS:**

**Lab Prerequisite:** Any programming language, Knowledge on Operating system principles.

**Hardware Requirements:** 2GB RAM,PC i3 processor and above

**Software Requirements:** C, IDE/Compiler (Geany). Linux Operating System

| Sr. No. | Detailed Lab/Tutorial Description |
|---|---|
| 1 | Implementation of File handling program. |
| 2 | Implementation of single pass Macro Processor. |
| 3 | Implementation of Lexical analysis phase of compilers. |
| 4 | Implementation of Parser (Any one). |
| 5 | Implementation of Intermediate code generation phase of compilers. |
| 6 | Implementation of code generation phase of compilers. |
| 7 | Explore usage of basic and advanced Linux Commands. For eg: (mkdir, chdir, cat, ls, chown, chmod, chgrp, ps etc). |
| 8 | Explore the file and process management system calls. |
| 9 | Write a program to demonstrate the concept of non-preemptive and preemptive scheduling algorithms. |
| 10 | Write a program in C demonstrate the concept of page replacement policies. |

**Lab Assessment:**

**1.Term work Assessment:**
Term work should consist of 8 experiments. Journal must include at least 2 assignments on content of theory and practical of "System Software & Operating Systems".The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. Total 25 Marks (Experiments: 15-marks, Attendance Theory & Practical: 05-marks, Assignments: 05-marks).

**2.Oral/Practical Assessment:**

Based on the experiments and entire syllabus.

Aim AY 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical /Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 291 | Programming Lab I ( Java Programming) | | 1#+2 | -- | - | 1 | -- | 1 |

1# to be taken class wise

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment (Review) | | | End Sem. Exam | | | | |
| | | 1(10) | 2(10) | Average | | | | | |
| EC 291 | Programming Lab I ( Java Programming) | - | - | - | - | 25 | – | 25 | 50 |

**Course Objectives:**

1. To understand Java's evolution, architecture, IDE usage, and basic I/O operations for program development.
2. To apply object-oriented programming principles for designing modular, maintainable, and efficient software solutions.
3. To explore inheritance, polymorphism, and advanced OOP features for enhancing code reusability and flexibility.
4. To utilize Java packages and JAR files for organizing code, encapsulation, and creating reusable libraries.
5. To manage exceptions and implement multithreaded applications with synchronization and concurrency concepts.
6. To design interactive GUIs and implement graphics programming for modern application development.

**Course Outcomes:**

After successful completion of the course students will be able to

1. Demonstrate proficiency in Java programming using its architecture, IDEs, and I/O operations.
2. Apply object-oriented programming techniques to solve real-world problems effectively.
3. Implement advanced OOP concepts like inheritance and polymorphism for scalable software development.

Adm Y 23-24

4. Create modular and reusable code using Java packages and libraries adhering to industry standards.
5. Develop robust applications by implementing exception handling and multithreading techniques.
6. Design and build interactive graphical user interfaces using JavaFX, Swing, and Java2D.

**DETAILED SYLLABUS:**

| Sr. No. | Module | Detailed Lab/Tutorial Description | No of Hours |
|---|---|---|---|
| 1 | Introduction to Java | 1.1 Java History, Java Features, **Java Editions (SE, EE, ME)**, 1.2 Java Virtual Machine **and Its Architecture**, 1.3 Data Types and Size 1.4 Java Program Development, **"Java IDEs"** like IntelliJ IDEA, Eclipse, or NetBeans 1.5 Java Source File Structure, Compilation, Executions. 1.6 **Basic I/O operations (reading from and writing to files or console)..** | 3 |
| 2 | Object-Oriented Programming Fundamentals | 2.1 Core OOP Concepts: Classes, Objects, Object References, Access Modifiers (private, protected, public), and static 2.2 Constructors and Initialization Blocks: Purpose, overloading, and use in object creation.2.3 Abstract Classes and Interfaces: Abstract methods, abstract classes, and Interfaces (default and static methods in Java 8+). 2.4 Object Class Basics: Methods like toString(), equals(), and hashCode(). | 5 |
| 3 | Advanced OOP - Inheritance and Polymorphism | 3.1 Inheritance: Benefits, Types (Single, Multilevel, Hierarchical), and Role of Constructors in Inheritance. 3.2 Polymorphism: Method Overloading (compile-time) and Method Overriding (runtime). 3.3 Advanced Features: Use of super, final for class/method restriction, Object Cloning, and Reusability Best Practices. | 5 |
| 4 | Packages | 4.1 Organizing Classes and Interfaces: Role of packages in modular design and logical grouping. 4.2 Access Protection: Use of packages for encapsulation and controlled access to classes/methods. 4.3 Creating and Using Packages: Defining packages, setting up classpath, compiling with packages. 4.4 Working with JAR Files: Creating reusable libraries (JAR files), importing packages, and static imports. 4.5 Best Practices: Naming conventions and guidelines for creating packages in professional environments. | 4 |

Adm 2023-24

| | | | |
|---|---|---|---|
| 5 | Exception Handling & Multithreading | 5.1 Introduction to Exceptions: Difference between Exceptions and Errors, Types of Exceptions (Checked and Unchecked). 5.2 Exception Handling Mechanisms: Control flow in exceptions, use of try, catch, finally, throw, and throws. 5.3 Custom Exceptions: Defining and handling user-defined exceptions. 5.4 Multithreading Basics: Introduction to threads, lifecycle of a thread, and creating threads using Thread class and Runnable interface. 5.5 Thread Management: Thread methods (start(), sleep(), join(), etc.), thread synchronization, and handling thread exceptions. 5.6 Concurrency Concepts: Basic introduction to thread safety and inter-thread communication. | 5 |
| 6 | Modern GUI Development and Graphics Programming in Java | **6.1 GUI Programming with JavaFX & Swing:** Introduction to modern GUI development using **Swing** and **JavaFX**, covering basic components like buttons, labels, and text fields, with event handling for user interactions. **6.2 Layouts & Design:** Use of layout managers in **Swing** (FlowLayout, BorderLayout) and **JavaFX** (HBox, VBox, GridPane) for creating responsive UIs. **6.3 Graphics Programming:** Drawing shapes, colors, and simple animations using **Java2D API** for graphics programming. | 4 |

Adm Y 25-24

**DETAILED LAB SYLLABUS:**

**Software Requirements:** Netbeans:https://netbeans.org/downloads/ J-Edit/J-Editor/Blue J

| Sr. No. | Detailed Lab/Tutorial Description |
|---|---|
| 1 | Write a Java program to demonstrate basic file and console I/O operations, such as reading input from the user and writing output to a file. |
| 2 | Create a Java program to define a class with attributes and methods. Implement constructors (default and parameterized) and demonstrate the use of access modifiers (private, public, protected). |
| 3 | Develop a program using an abstract class and an interface with Java features like default and static methods. Show polymorphism with overriding methods. |
| 4 | Design a program to demonstrate single and multilevel inheritance. Implement method overriding to achieve runtime polymorphism and use the super keyword. |
| 5 | Write a program to demonstrate object cloning in Java. Show how to create deep copies of objects and reuse methods for efficient design. |

| | |
|---|---|
| 6 | Create a Java project with multiple packages to organize classes logically. Include encapsulation and access protection, compile with classpath settings, and create a JAR file for reuse. |
| 7 | Write a program to demonstrate the use of try-catch-finally, throw, and throws. |
| 8 | Develop a multithreaded program to simulate a real-world scenario . |
| 9 | Build a GUI application using JavaFX or Swing. Implement buttons, labels, text fields, and event handling. Incorporate basic Java2D API features to draw shapes and create a simple animation. |
| 10 | Mini Project |

**Guidelines for Mini Project**

- Students shall form a group of 3 to 4 students, while forming a group shall not be allowed less than three or more than four students, as it is a group activity.
- Students should do surveys and identify needs, which shall be converted into problem statements for mini projects in consultation with faculty supervisor/head of department/internal committee of faculties.
- Students shall submit an implementation plan, which will cover weekly activity of mini projects.
- A log book to be prepared by each group, wherein the group can record weekly work progress, guide/supervisor can verify and record notes/comments.
- Faculty supervisor may give inputs to students during mini project activity; however, focus shall be on self-learning.
- Students in a group shall understand the problem effectively, propose multiple solutions and select the best possible solution in consultation with the guide/ supervisor. The solution to be validated with proper justification and report to be compiled in standard format.

**Lab Assessment:**

**1.Term work Assessment:**

For performance experiments : **10-**Marks

Attendance : 05 Marks

Quality of Project report : **10** Marks

**2.Oral/Practical Assessment:**

Viva exam will be based on the experiments and project implemented in the semester.

Adm y 23-24

## Semester III

| Course Code | Course Name | Category | Course Component | Teaching Scheme (Contact Hours) | | Credits Assigned | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | Pract /Tuts | Theory | Pract /Tuts | Total |
| EC 201 | Engineering Mathematics III | ESC | T | 3 | - | 3 | - | 3 |
| EC 202 | Analog Electronics Circuits | PCC | TL | 3 | - | 3 | | 3 |
| EC 203 | Digital Circuits & System Design | PCC | TL | 3 | - | 3 | - | 3 |
| EC 204 | Data Structures & Algorithms | MDM | TL | 3 | 2 | 3 | 1 | 4 |
| EC 205 | Database Management System | PCC | TLP | 3 | 2 | 3 | 1 | 4 |
| EC 206 | Personal Finance Management | HSSM | T | 2 | - | 2 | - | 2 |
| EC 207 | Human Values and Social Ethics | | T | 2 | - | 2 | - | 2 |
| EC 208 | Analog & Digital Electronics Lab | PCC | LP | - | 2 | - | 1 | 1 |
| **Total** | | | | **19** | **6** | **19** | **3** | **22** |

| Course Code | Course Name | Category | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Theory | | | | | Term Work | Pract /Oral | Total |
| | | | Internal Assessment | | | End Sem Exam | Exam Duration (Hrs) | | | |
| | | | 1 | 2 | Avg | | | | | |
| EC 201 | Engineering Mathematics III | ESC | 40 | 40 | 40 | 60 | 2 | - | - | 100 |
| EC 202 | Analog Electronics Circuits | PCC | 40 | 40 | 40 | 60 | 2 | - | - | 100 |
| EC 203 | Digital Circuits & System Design | PCC | 40 | 40 | 40 | 60 | 2 | - | - | 100 |
| EC 204 | Data Structures & Algorithms | MDM | 40 | 40 | 40 | 60 | 2 | 25 | 25 | 150 |
| EC 205 | Database Management System | PCC | 40 | 40 | 40 | 60 | 2 | 25 | 25 | 150 |
| EC 206 | Personal Finance Management | HSSM | 20 | 20 | 20 | 40 | 2 | - | - | 60 |
| EC 207 | Human Values and Social Ethics | | - | - | - | - | - | 50 | - | 50 |
| EC 208 | Analog & Digital Electronics Lab | PCC | - | - | - | - | - | 25 | 25 | 50 |
| **Total** | | | | | | | | | | **760** |

1# to be taken class wise **T- Theory , L- Lab , P-Programming, C- Communicatio**

AGM AY 23-24

## Semester IV

| Course Code | Course Name | Category | Course Component | Teaching Scheme (Contact Hours) | | Credits Assigned | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | Pract/Tuts | Theory | Pract/Tuts | Total |
| EC 209 | Engineering Mathematics IV | ESC | T | 3 | - | 3 | - | 3 |
| EC 210 | Analysis of Algorithms | PCC | T | 3 | 2 | 3 | 1 | 4 |
| EC 211 | Basics of VLSI Design | PCC | TLP | 3 | 2 | 3 | 1 | 4 |
| EC 212 | System Software and Operating Systems | MDM | T | 3 | - | 3 | - | 3 |
| EC 213 | Microprocessor and Microcontroller | PCC | T | 3 | 2 | 3 | 1 | 4 |
| EC 214 | Entrepreneurship | HSSM | T | 2 | - | 2 | - | 2 |
| EC 215 | System Software and Operating Systems Lab | Skill Courses | L | - | 2 | - | 1 | 1 |
| EC 291 | Programming Lab I ( Java Programming) | Experiential Learning Courses | LP LPC | - | 1*+ 2 | - | 1 | 1 |
| **Total** | | | | **17** | **11** | **17** | **5** | **22** |

| Course Code | Course Name | Category | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Theory | | | | | Term Work | Pract/ Oral | Total |
| | | | Internal Assessment | | | End Sem Exam | Exam Duration (Hrs) | | | |
| | | | 1 | 2 | Avg | | | | | |
| EC 209 | Engineering Mathematics IV | ESC | 40 | 40 | 40 | 60 | 2 | - | - | 100 |
| EC 210 | Analysis of Algorithms | PCC | 40 | 40 | 40 | 60 | 2 | 25 | 25 | 150 |
| EC 211 | Basics of VLSI Design | PCC | 40 | 40 | 40 | 60 | 2 | 25 | 25 | 150 |
| EC 212 | System Software and Operating Systems | MDM | 40 | 40 | 40 | 60 | 2 | - | - | 100 |
| EC 213 | Microprocessor and Microcontroller | PCC | 40 | 40 | 40 | 60 | 2 | 25 | 25 | 150 |
| EC 214 | Entrepreneurship | HSSM | 20 | 20 | 20 | 40 | 2 | - | - | 60 |
| EC 215 | System Software and Operating Systems Lab | Skill Courses | - | - | - | - | - | 25 | 25 | 50 |
| EC 291 | Programming Lab I ( Java Programming) | Skill Courses | - | - | - | - | - | 25 | 25 | 50 |
| **Total** | | | | | | | | | | **810** |

1# to be taken class wise

**T- Theory , L- Lab , P-Programming, C- Communication**

Adm Y 23-24

# Bachelor of Technology

# In

# Electronics & Computer Science

# (Semester III)

Adm Y 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical/Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 201 | Engineering Mathematics III | 03 | - | - | 03 | - | - | 03 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | 1 | 2 | Average | | | | | |
| EC 201 | Engineering Mathematics-III | 40 | 40 | 40 | 60 | - | - | - | 100 |

**Prerequisite:** Engineering Mathematics-I and Engineering Mathematics-2

**Course Objectives:**

1. Learn the Laplace Transform, Inverse Laplace Transform of various functions, its applications.
2. Understand the concept of Fourier Series, its complex form and enhance the problem solving skills.
3. Understand Matrix algebra for engineering problems.
4. Understand the concept of complex variables, C-R equations with applications.
5. Understand the concept of Relation and function.
6. Understand the concept of coding theory

**Course Outcomes:**

After successful completion of the course students will be able to

1. Apply the concept of Laplace transform and its application to solve the real integrals in engineering problems.
2. Expand the periodic function by using the Fourier series for real-life problems and complex engineering problems.
3. Apply the concepts of Eigen values and eigenvectors in engineering problems.
4. Apply complex variable theory, application of harmonic conjugate to get orthogonal trajectories and analytic functions.
5. Apply the concept of relation and function.
6. Use groups and codes in Encoding-Decoding.

**DETAILED THEORY SYLLABUS:**

| Sr. No. | Module | Detailed Content | Hrs. |
|---|---|---|---|
| 1. | **Laplace Transform** | Definition of Laplace transform and Laplace transform of standard functions, Properties of Laplace Transform: Linearity, First Shifting Theorem, change of | 07 |

Adm. 23-24

| | | | |
|---|---|---|---|
| | | scale Property, multiplication by t, Division by t, (Properties without proof). Inverse of Laplace Transform by partial fraction and convolution theorem. | |
| 2. | **Fourier Series , Fourier Transform** | Dirichlet's conditions, Fourier series of periodic functions with period 2π and 2L, Fourier series for even and odd functions, Half range sine and cosine Fourier series, Orthogonal and Ortho-normal functions, Fourier Integral Representation, Fourier Transform and Inverse Fourier transform of constant and exponential function. | 06 |
| 3. | **Linear Algebra Matrix Theory, Quadratic Forms** | Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, Quadratic forms over real field, Linear Transformation of Quadratic form, Reduction of Quadratic form to diagonal form using congruent transformation.<br>Rank, Index and Signature of quadratic form, Sylvester's law of inertia, Value-class of a quadratic form-Definite, Semidefinite and Indefinite.<br>Reduction of Quadratic form to a canonical form using congruent transformations. | 07 |
| 4. | **Complex Variables and conformal mappings** | Function f(z)of complex variable, Introduction to Limit, Continuity and Differentiability of (z), Analytic function: Necessary and sufficient conditions for f(z) to be analytic, Cauchy-Riemann equations in Cartesian coordinates, Milne-Thomson method: Determine analytic function f(z)when real part(u), imaginary part (v) or its combination (u+v / u-v) is given, Conformal mapping, Linear and Bilinear mappings, cross ratio | 06 |
| 5. | **Relation and Function** | Partition of A Set, Relation, Diagram of A Relation, Matrix of A Relation, Digraph of A Relation, Types of Relation, Number of Binary Relations, Number of Reflexive Relations, Equivalance Relation, Relation of the Path, Operations on Relations, Closures, Warshall's Algorithm, | 07 |
| 6. | **Algebraic Structures, coding theory** | Properties of Binary Operations, Semi-Group. Monoid, Group, Ring, Isomorphism, Homomorphism, Group Code, Decoding and Error Correction, Maximum Likelihood Technique | 06 |

**Theory Assessments:**

**1. Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.

**2. End Sem Theory Examination:**

- Question paper will consist of 4 questions, each carrying 20 marks.
- Total 3 questions need to be solved.
- Q.1 will be compulsory, based on the entire syllabus.
- Remaining questions will be randomly selected from all the modules.
- Weightage of marks should be proportional to number of hours assigned to each module.

**Lab Assessment:**

**1. Term work Assessment:**

Term work should consist of all the work done in tutorials and assignments. The final certification and acceptance of term work ensures satisfactory performance throughout in all the assigned work.

**Text Books & References:**


1. Complex Variables and Applications, Brown and Churchill, McGraw-Hill education.
2. Advanced engineering mathematics H.K. Das, S . Chand, Publications.
3. Higher Engineering Mathematics B. V. Ramana, Tata Mc-Graw Hill Publication
4. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Narosa publication


Adm AY 23-24

5. Advanced Engineering Mathematics Wylie and Barret, Tata Mc-Graw Hill.
6. Beginning Linear Algebra Seymour Lipschutz Schaum's outline series, Mc-Graw Hill Publication
7. Higher Engineering Mathematics, Dr. B. S. Grewal, Khanna Publication
8. Discrete Mathematical Structures Bernard Kolman, Robert C. Busby ,Sharon Cutler Ross, Nadeem-ur-Rehman, " Pearson Education".
9. Discrete Mathematical Structures: Theory and Applications, D.S. Malik and M.K. Sen: Cengage Learning, 2004.
10. Discrete Mathematics with Applications, Thomas Koshy: Elsevier, 2005, Reprint 2008.

Adm Y 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical/ Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 202 | Analog Electronics Circuits | 03 | 02 | -- | 03 | 01 | -- | 04 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | 1 | 2 | Average | | | | | |
| EC 202 | Analog Electronics Circuits | 40 | 40 | 40 | 60 | - | - | -- | 100 |

**Prerequisite:** Basic Electrical Engineering

**Course Objectives:**

1. To enhance comprehension capabilities of students through understanding of electronic circuits.
2. To perform DC and AC analysis of BJT and MOSFET amplifier circuits.
3. To teach fundamental principles of operational amplifiers.
4. To develop an overall approach for students from selection of integrated circuit, specification, functionality and applications.

**Course Outcomes:**

After successful completion of the course students will be able to

1. Understand construction, characteristics and working of semiconductor devices such as BJT, MOSFET.
2. Derive expressions for performance parameters of BJT and MOSFET based Electronic circuits
3. Select and Design electronic circuits (using BJT and MOSFET) for given specifications
4. Derive and determine various performances-based parameters and their significance for Op-Amp.
5. Analyze and identify the closed loop stability considerations, linear and nonlinear applications of operational amplifiers.
6. Design an application with the use of integrated circuits.

**DETAILED THEORY SYLLABUS:**

| Sr. No. | Module | Detailed Content | Hrs. |
|---|---|---|---|
| 1. | **Semiconductor devices** | 1.1Bipolar Junction Transistor - BJT operations, voltages and current equations, BJT characteristics (CE, CB, CC configurations), early effect.<br>1.2 Field Effect Devices-<br>JFET: Construction, operation and characteristics.<br>MOSFET: Construction, operation and characteristics of D-MOSFET and EMOSFET. | 06 |

Autonomy 23-24

| | | | |
|---|---|---|---|
| 2. | **Biasing Circuits of BJTs and MOSFETs** | 2.1 Concept of DC load line, Q point and regions of operations, Analysis and design of biasing circuits for BJT (Voltage divider Bias ONLY)<br>2.2 DC load line and region of operation for MOSFETs. Analysis and design of biasing circuits for E-MOSFET ( voltage divider bias ONLY). | 06 |
| 3. | **Small Signal Amplifiers** | 3.1Concept of AC load line and Amplification, Small signal analysis (Zi, Zo, Av and Ai) of CE amplifiers using hybrid pi model ONLY.<br>3.2 Small signal analysis (Zi, Zo, Av) of CS (for EMOSFET) amplifiers. Introduction to multistage amplifiers. Cascade and cascode only.(Concept, advantages & disadvantages) | 07 |
| 4. | **Operational Amplifiers** | 4.1The ideal operational amplifier (op-amp), internal block diagram of op-amp, characteristics of op-amp, ideal & practical op-amp parameters / specifications (no detailed description or any analysis), mathematical model of op-amp, IC 741 op-amp with pin diagram & description<br>4.2 Operational amplifier open loop & closed loop configurations (theoretical description only), the concept of virtual ground & virtual short | 06 |
| 5. | **Applications of Operational Amplifier** | 5.1 The op-amp inverting amplifier & op-amp non-inverting amplifier (mathematical analysis for derivation of output voltage only,numerical examples & designing)<br>5.2 Adder, summing amplifier, averaging circuit, subtractor, integrator (ideal), differentiator (ideal), op-amp instrumentation amplifier (only mathematical analysis for derivation of output voltage) | 07 |
| 6. | **Special Purpose Integrated Circuits** | 6.1 IC 555 timer internal block diagram & pin configuration, operation in astable & monostable multivibrator with mathematical analysis & numerical examples, design problems on astable & monostable multivibrator, applications in astable & monostable configuration<br>6.2 Functional block diagram, working and design of general purpose IC 723 (HVLC and HVHC).(theoretical description only). working of the switching regulator.<br>(theoretical description only) | 07 |

**Theory Assessments:**

**1. Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.

2. **End Sem Theory Examination:**

- Question paper will consist of 4 questions, each carrying 20 marks.
- Total 3 questions need to be solved.
- Q.1 will be compulsory, based on the entire syllabus.
- Remaining questions will be randomly selected from all the modules.
- Weightage of marks should be proportional to the number of hours assigned to each module.

**Books:**


1. Donald A. Neamen, “Electronic Circuit Analysis and Design”, TATA McGraw Hill, 2nd Edition.
2. Ramakant A. Gayakwad, “Op-Amps and Linear Integrated Circuits”, Pearson Prentice Hall, 4th Edition.


**References:**


1. Robert Boylestad," Electronic Devices and Circuit Theory", Pearson.
2. George Clayton and Steve Winder, “Operational Amplifiers”, NewnesBali, “Linear Integrated Circuits”, Mc Graw Hill


Adm Yr 23-24

3. Gray, Hurst, Lewise, Meyer, “Analysis & Design of Analog Integrated Circuits, Wiley Publications.
4. K. R. Botkar, “Integrated Circuits”, Khanna Publishers (2004)
5. S. Salivahanan, N. Suresh Kumar,“Electronic Devices and Circuits”, Tata McGraw Hill.
6. D. Roy Choudhury and S. B. Jain, “Linear Integrated Circuits”, New Age International Publishers, 4th Edition.
7. Sergio Franco, “Design with operational amplifiers &analog integrated circuits”, Tata McGraw Hill, 3rd edition
8. William D. Stanley, “Operational Amplifiers with Linear Integrated Circuits”, Pearson, 4th Edition

Adm Y 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical/ Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 203 | Digital Circuits & System Design | 03 | 02 | -- | 03 | 01 | -- | 04 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | 1 | 2 | Average | | | | | |
| EC 203 | Digital Circuits & System Design | 40 | 40 | 40 | 60 | - | -- | - | 100 |

**Prerequisite:** Physics of Std 11th, 12th and FE - Basic Electrical & Electronics Engineering

**Course Objectives:**

1. To understand various number systems & codes and to introduce students to various logic gates, SOP, POS form and their minimization techniques.
2. To teach the working of combinational circuits, their applications and implementation of combinational logic circuits using MSI chips.
3. To teach the elements of sequential logic design, analysis and design of sequential circuits.
4. To understand various counters and shift registers and its design using MSI chips.
5. To explain and describe various logic families, their interfacing and Programmable Logic Devices.
6. To train students in writing programs with VHDL hardware description languages.

**Course Outcomes:**

After successful completion of the course students will be able to

1. Perform code conversion and able to apply Boolean algebra for the implementation and minimization of logic functions.
2. Analyze, design and implement Combinational logic circuits.
3. Analyze, design and implement Sequential logic circuits.
4. Design and implement various counter using flip flops and MSI chips.
5. Understand TTL & CMOS logic families, PLDs, CPLD and FPGA.
6. Understand basics of VHDL Hardware Description Language and its programming with combinational and sequential logic circuits.

Adm-X 23-24

**DETAILED THEORY SYLLABUS:**

| Sr. No. | Module | Detailed Content | Hrs. |
|---|---|---|---|
| 1. | **Logic Gates and Boolean Algebra** | Digital logic gates, Realization using NAND, NOR gates, Boolean Algebra, De Morgan's Theorem, SOP and POS representation, K Map up to four variables. | 04 |
| 2. | **Combinational Circuits using basic gates as well as MSI devices** | Arithmetic Circuits: Half adder, Full adder, Ripple carry adder, Carry Look ahead adder, Half Subtractor, Full Subtractor, multiplexer, cascading of Multiplexer, demultiplexer, decoder, Comparator (Multiplexer and demultiplexer gate level upto 4:1). MSI devices: IC7483, IC74151, IC74138, IC7485. | 07 |
| 3. | **Elements of Sequential Logic Design** | Sequential Logic: Latches and Flip-Flops. RS, JK, Master slave flip flops, T & D flip flops with various triggering methods, Conversion of flip flops<br>Counters: Asynchronous, Synchronous Counters, Up Down Counters, Mod Counters, Ring Counter, Twisted ring counter, Shift Registers, Universal Shift Register. | 07 |
| 4. | **Sequential Logic Design** | Sequential Logic Design: Mealy and Moore Machines, Clocked synchronous state machine analysis, State reduction techniques (inspection, partition and implication chart method) and state assignment, sequence detector, Clocked synchronous state machine design.<br>Sequential logic design practices: MSI counters (7490, 7492, 7493,74163, 74169) and applications, MSI Shift registers (74194) and their applications. | 07 |
| 5. | **Logic Families and Programmable Logic Devices** | Logic Families: Types of logic families (TTL and CMOS), characteristic parameters (propagation delays, power dissipation, Noise Margin, Fan-out and Fan-in), transfer characteristics of TTL NAND (Operation of TTL NAND gate),CMOS Logic: CMOS inverter, CMOS NAND and CMOS NOR, Interfacing CMOS to TTL and TTL to CMOS.<br>Programmable Logic Devices: Concepts of PAL and PLA. Simple logic implementation using PAL and PLA, Introduction to CPLD and FPGA architectures. | 07 |
| 6. | **Introduction to VHDL** | Design of Combinational circuits using VHDL: Introduction to Hardware Description Language, Core features of VHDL, data types, concurrent and sequential statements, data flow, behavioral, structural architectures, subprograms, Examples like Adder, subtractor, Multiplexers, De-multiplexers, decoder.<br>Design of Sequential circuits using VHDL: VHDL code for flip flop, counters. | 07 |

AQAD 23-24

**Theory Assessments:**

**1. Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.

**2. End Sem Theory Examination:**

- Question paper will consist of 4 questions, each carrying 20 marks.
- Total 3 questions need to be solved.
- Q.1 will be compulsory, based on the entire syllabus.
- Remaining questions will be randomly selected from all the modules.
- Weightage of marks should be proportional to the number of hours assigned to each module.

**Books:**


1. R. P. Jain, Modern Digital Electronics, Tata McGraw Hill Education, Third Edition 2003.
2. Morris Mano, Digital Design, Pearson Education, Asia 2002.
3. J Bhaskar, VHDL Primer, Prentice Hall, Third Edition (1999 ).


**References:**


1. Digital Logic Applications and Design – John M. Yarbrough, Thomson Publications, 2006
2. John F. Warkerly, Digital Design Principles and Practices, Pearson Education, Fourth Edition, 2008.
3. Stephen Brown and Zvonko Vranesic, Fundamentals of digital logic design with VHDL, McGraw Hill, 2nd Edition.
4. Volnei A. Pedroni, “Circuit Design with VHDL” MIT Press (2004)
5. Digital Circuits and Logic Design – Samuel C. Lee , PHI
6. William I.Flectcher, “An Engineering Approach to Digital Design”, Prentice Hall of India.
7. Parag K Lala, “Digital System design using PLD”, BS Publications, 2003.
8. Charles H. Roth Jr., “Fundamentals of Logic design”, Thomson Learning, 2004.


Adm Y 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical /Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 204 | Data Structures and Algorithms | 03 | 02 | -- | 03 | 01 | -- | 04 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | 1 | 2 | Average | | | | | |
| EC 204 | Data Structures and Algorithms | 40 | 40 | 40 | 60 | 25 | – | 25 | 150 |

**Prerequisite:** C Programming

**Course Objectives:**

1. To teach concept and implementation of linear and nonlinear data structures.
2. To analyze various data structures and select the appropriate one to solve a specific real-world problem.
3. To introduce various techniques for representation of the data in the real world.

**Course Outcomes:**

After successful completion of the course students will be able to

1. Students will be able to implement linear and Non-Linear data structures.
2. Students will be able to handle various operations like searching, insertion, deletion and traversals on various data structures.
3. Students will be able to explain various data structures, related terminologies and its types.
4. Students will be able to choose appropriate data structure and apply it to solve problems in various domains.
5. Students will be able to analyze and Implement appropriate sorting and searching techniques for a given problem.
6. Students will be able to demonstrate the ability to analyze, design, apply and use data structures to solve engineering problems and evaluate their solutions.

Adm Y23-24

**DETAILED THEORY SYLLABUS:**

| Sr. No. | Module | Detailed Content | Hrs. |
|---|---|---|---|
| 1 | **Introduction to Data Structures** | Introduction to Data Structures, Types of Data Structures – Linear and Nonlinear, Operations on Data Structures, Concept of array, Static arrays vs Dynamic Arrays, structures, Array Data Type:- Single and Multidimensional Arrays. Introduction to Analysis of Algorithms, characteristics of algorithms, Time and Space complexities, Asymptotic notations. | 04 |
| 2 | **Stack and Queue** | **Stack:** Basic Stack Operations, Representation of a Stack using Array, Applications of Stack – Well form-ness of Parenthesis, Infix to Postfix Conversion and Postfix Evaluation.<br>**Queue:** Operations on Queue, Array Implementation of Queue, Types of Queue-Circular Queue, Priority Queue, Dequeue, queue-Round Robin Algorithm, Applications of Queue:- Interrupt handling | 07 |
| 3 | **Linked List** | Representation of Linked List, Linked List v*/s* Array, Types of Linked List - Singly Linked List (SLL), Doubly Linked List, Circular Linked List, Operations on Singly Linked List: Insertion, Deletion, reversal of SLL, Print SLL. Implementation of Stack and Queue using Singly Linked List. Singly Linked List Application-Documenting a sequence of heterogeneous records. | 08 |
| 4 | **Tree** | Tree Terminologies, Binary Tree, Types of Binary Tree, Binary Tree Representation: Array and Linked Representation of Binary trees, Binary Tree Traversals algorithms: In-order, Pre-order, Post-order, Binary Search Tree Operations on Binary Search Tree, Applications of Binary Tree - Expression Tree, Huffman Encoding. | 07 |
| 5 | **Graph** | Graph Terminologies, Representation of graph (Adjacency matrix and adjacency list), Graph Traversals – Depth First Search (DFS) and Breadth First Search (BFS), Connected Component, Spanning Trees, Minimum Cost Spanning Trees: Prims and Kruskal's algorithm, Application of Graph – Topological Sorting. | 06 |
| 6 | **Sorting and Searching** | **Searching:** Linear search, Random search, Binary search, Hashing, Applications:- Finding a root of a general quadratic polynomial over a finite interval.<br>**Sorting:** Bubble, Insertion, selection, Quick Sort, Merge Sort, Two Way Merge Sort, Counting sort, Comparison of sorting Techniques based on their complexity, A few practical considerations for in-memory sorting | 07 |

**DETAILED LAB SYLLABUS:**

**Software Requirements:** Turbo C/Code Blocks, Windows/Linux

| Sr. No. | Detailed Lab/Tutorial Description |
|---|---|
| 1 | Program to reverse a list of given numbers using stack ADT. |
| 2 | Program to Check whether parentheses are balanced or not. |
| 3 | Convert an Infix expression to Postfix expression using stack ADT. |
| 4 | Program to evaluate Postfix Expression using Stack ADT. |
| 4 | Program to implement Linear Queue ADT using array. |
| 5 | Program to implement Stack/Queue using linked list. |
| 6 | Program to implement Circular Queue ADT using array. |

Adm. 2024

| | |
|---|---|
| 7 | Program to implement Priority Queue ADT using array. |
| 8 | Program to implement Binary Search Tree ADT using Linked List. |
| 9 | Program to implement searching algorithms -Linear search, Binary search. |
| 10 | Implement Depth First Search and Breadth First Search Graph Traversal technique. |
| 11 | Program to implement sorting algorithms (any 2)- bubble, selection, insertion, merge, quick. |
| 12 | Implementation of Prim's and Kruskal's algorithms for finding out Minimum Cost Spanning Tree of a given input graph. For eg. Finding out electricity distribution cable network with minimum overall cable length. |

**Theory Assessments:**

**1. Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.

**2. End Sem Theory Examination:**

- Question paper will consist of 4 questions, each carrying 20 marks.
- Total 3 questions need to be solved.
- Q.1 will be compulsory, based on the entire syllabus.
- Remaining questions will be randomly selected from all the modules.
- Weightage of marks should be proportional to number of hours assigned to each module.

**Lab Assessment:**

**1. Term work Assessment :**

The experiments should be student centric and attempt to make experiments more meaningful, interesting and innovative. Term work assessment must be based on the overall performance of the student with every experiment and assignments are graded from time to time.

**2. Oral/Viva Assessment:**

The oral examination will be based on the entire syllabus.

**Text Books:**


1. Aaron M Tenenbaum, Yedidyah Langsam, Moshe J Augenstein, "Data Structures Using C", Pearson Publication.
2. Jean Paul Tremblay, P. G. Sorenson, "Introduction to Data Structure and Its Applications", McGraw-Hill Higher Education
3. Thomas H. Cormen, Charles E. Leiserson, Ronald Rivest, Clifford Stein, "Introduction to Algorithms", PHI Learning Pvt. Ltd. (Originally MIT Press); Third edition, 2010
4. Mark A.Weiss, "Data Structures and Algorithm Analysis in C", Pearson Education India; 2nd edition, 2002.
5. Data Structures using C and C++, Rajesh K Shukla, Wiley - India
6. Data Structures Using C, Aaron M Tenenbaum, Yedidyah Langsam, Moshe J Augenstein, Pearson.
7. Data Structures: A Pseudocode Approach with C, Richard F. Gilberg & Behrouz A., Forouzan, Second Edition, CENGAGE Learning.
8. Introduction to Data Structure and Its Applications, Jean Paul Tremblay, P. G. Sorenson.


**Reference Books:**


1. C & Data Structures, Prof. P.S. Deshpande, Prof. O.G. Kakde, DreamTech press
2. E. Balagurusamy, "Data Structure Using C", Tata McGraw-Hill Education India
3. Rajesh K Shukla, "Data Structures using C and C++", Wiley-India


Appr. AY 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical /Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 205 | Database Management System | 03 | 02 | – | 03 | 01 | – | 04 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | 1 | 2 | Average | | | | | |
| EC 205 | Database Management System | 40 | 40 | 40 | 60 | 25 | 25 | -- | 150 |

**Prerequisite:** Data Structures

**Course Objectives:**

1. Develop entity relationship data model and its mapping to relational model
2. Learn relational algebra and Formulate SQL queries.
3. Apply normalization techniques to normalize the database.
4. Understand the concept of transaction, concurrency control and recovery techniques.

**Course Outcomes:** After successful completion of the course students will be able to

1. Recognize the need of database management system
2. Design ER diagram for real life applications.
3. Construct relational models and write relational algebra queries.
4. Formulate SQL queries.
5. Apply the concept of normalization to relational database design.
6. Describe the concept of transaction, concurrency and recovery.

**DETAILED THEORY SYLLABUS:**

| Sr. No. | Module | Detailed Content | Hrs. |
|---|---|---|---|
| 1 | **Introduction Database Concepts** | Introduction, Characteristics of databases, File system v/s Database system, Data abstraction and data Independence, DBMS system architecture, Database Administrator | 04 |

Adm. 23-24

| | | | |
|---|---|---|---|
| 2 | **Entity–Relationship Data Model** | The Entity-Relationship (ER) Model: Entity types: Weak and strong entity sets, Entity sets, Types of Attributes, Relationship constraints: Cardinality and Participation, | 06 |
| 3 | **Relational Model and relational Algebra** | Introduction to the Relational Model, relational schema and concept of keys. Relational Algebra-operators, Relational Algebra Queries. | 07 |
| 4 | **Structured Query Language (SQL)** | Overview of SQL, Data Definition Commands, Integrity constraints: key constraints, Domain Constraints, Referential integrity , check constraints, Data Manipulation commands, Data Control commands, Set and string operations, aggregate functions, group by, having, Views in SQL, joins, Nested and complex queries, Triggers. | 08 |
| 5 | **Relational-Data base Design** | Concept of normalization, Function Dependencies, First Normal Form, 2NF, 3NF, BCNF. | 06 |
| 6 | **Transactions Management and Concurrency and Recovery** | Transaction concept, Transaction states, ACID properties, Transaction Control Commands, Concurrent Executions, Serializability-Conflict and View, Concurrency Control: Lock-based, Timestamp-based protocols, Recovery System: Log based recovery, Deadlock handling. | 07 |

**DETAILED LAB SYLLABUS:**

**Hardware Requirements:** 2GB RAM

**Software Requirements:** SQL server (Oracle/MySQL/PostGreSQL)

| Sr. No. | Detailed Lab/Tutorial Description |
|---|---|
| 1 | Identify the case study and detail statement of the problem. Design an Entity-Relationship(ER) / Extended Entity-Relationship (EER) Model. |
| 2 | Mapping ER/EER to Relational schema model. |
| 3 | Create a database using Data Definition Language (DDL) and apply integrity constraints for the specified System. |
| 4 | Apply DML Commands for the specified system. |
| 5 | Perform Simple queries, string manipulation operations and aggregate functions. |
| 6 | Implement Views and Join operations. |
| **7** | Perform Nested and Complex queries |

Adm Y 23-24

| | |
|---|---|
| 8 | Perform DCL and TCL commands. |
| 9 | Implement function and trigger. |
| 10 | Demonstrate Database connectivity |
| 11 | Implementation and demonstration of Transaction and Concurrency control techniques using locks. |

**Theory Assessments:**

**1. Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.

**2. End Sem Theory Examination:**

- Question paper will consist of 4 questions, each carrying 20 marks.
- Total 3 questions need to be solved.
- Q.1 will be compulsory, based on the entire syllabus.
- Remaining questions will be randomly selected from all the modules.
- Weightage of marks should be proportional to number of hours assigned to each module.

**Lab Assessment:**

**1.Term work Assessment:**

Term work should have min. 8 experiments. Journal must include at least 2 assignments on content of theory and practical of "Database Management System". The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. Total 25 Marks (Experiments: 15-marks, Attendance Theory & Practical: 05-marks, Assignments: 05-marks).

**2.Oral/ Practical Assessment:**

The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. Practical and Oral exam will be based on the entire syllabus.

**Books:**


1. Korth, Slberchatz, Sudarshan, Database System Concepts, 6thEdition, McGraw Hill.
2. Elmasri and Navathe, Fundamentals of Database Systems, 5thEdition, Pearson Education.
3. Raghu Ramkrishnan and Johannes Gehrke, Database Management Systems, TMH.


**References:**


1. Microsoft SQL Server Black Book By Patrick Dalton.
2. https://www.w3schools.com/sql/
3. https://www.postgresqltutorial.com/


Adm Y 23-24

| Course Code | Course Name | Scheme | Theory | Practical | Tutorial | Total |
|---|---|---|---|---|---|---|
| EC 206 | Personal Finance Management | Contact Hours | 2 | - | - | 2 |
| | | Credits | 2 | - | - | 2 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal Assessment | | | End Sem Exam | | | | |
| | | 1 | 2 | Average | | | | | |
| EC 206 | Personal Finance Management | 20 | 20 | 20 | 40 | - | - | -- | 60 |

**Course Objectives**: The course or instructor aims

1. To introduce the basic concepts of finance and their practical application .
2. To demonstrate the process of drafting a financial budget.
3. To explain investment avenues and planning of personal finance.
4. To develop portfolio strategies for individual and institutional investor.
5. To discuss various components of insurance and tax management.
6. To introduce financial frauds , measures to avoid frauds and resources of frauds .

**Course Outcomes**: On successful completion of course learner/student will be able:

1. To know basic concepts of finance and interpret current business positions by reading books of accounts .
2. To analyze investment avenues and plan personal finance to develop portfolio strategies for individuals .
3. To Develop skills to interpret current market position.
4. To Create analytical approach for financial decisions.
5. To learn and understand Tax and Insurance management.
6. To identify financial frauds and understand the level of financial aspects .

Adm Y 23-24

**Detailed Theory Syllabus:**

| Sr. No. | Module | Detailed Contents of Module | Hrs |
|---|---|---|---|
| 1 | Introduction to Personal Financial Planning | Financial Planning Process: Goal, Vision and mission, Components of Personal Financial Plan, Advantages of developing personal financial plan. | 3 |
| 2 | Financial Budget | Meaning and Process of Drafting Financial Budget,Components of Financial Budget, Drafting Financial Budget. | 3 |
| 3 | Investment Management | Meaning of Investment, Concept of Risk and Return and Time Value of Money, Investment Avenues, Portfolio Creation and Management. | 6 |
| 4 | Insurance and Spending Management | Components of Insurance: Life Insurance, Health Insurance, Property Insurance, Spending Management. | 3 |
| 5 | Tax Management | Introduction to Tax Regime and Tax Returns,Introduction to Income Tax and its impact on Incomes ,Tax on property: Revenue and Capital Incomes,Tax Management, Tax Saving, Tax Avoidance | 3 |
| 6 | Financial Frauds | Meaning and Types of Fraud,Investment Frauds, Online Payment Frauds, Identity Theft, Mass Marketing Fraud ,Measures to avoid frauds,Recourse from frauds,Cases of Frauds | 6 |

**Theory Assessment:**

**Internal Assessment: 20 marks**

Consisting of Two compulsory internal assessments 20 Marks each. The final marks will be the average score of both the assessments.

**End Semester Examination: 40 Marks**

Weightage of each module in the end semester examination will be proportional to the number of respective lecture hours mentioned in the curriculum.

**Books and References:**


1. Financial Management: I M Pandey, Vikas Publishing House.
2. Financial Management: M.Y. Khan, P.K. Jain, Tata McGraw Hill.
3. Financial Management: Prassana Chandra, Prentice Hall.
4. Investment Analysis & Portfolio Management- Prasanna Chandra, Tata McGrawHill
5. Wealth Management- Dun & Bradstreet, Tata McGrawHill
6. Wealth Management- S.K .Bagachi, Jaico publishing house


Adm Y 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical/ Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 207 | Human Values and Social Ethics | 02 | -- | -- | 02 | -- | -- | 02 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | 1 | 2 | Average | | | | | |
| EC 206 | Human Values and Social Ethics | -- | -- | -- | -- | 50 | -- | -- | 50 |

**Prerequisite:** Should have respect for justice and be able to reflect on one's personal beliefs and values.

**Course Objectives:**

1. To enable learners to understand the core values that shape the ethical behaviour of a professional.
2. To develop an awareness on the different ethical dilemmas at the work place and society.
3. To inculcate the ethical code of conduct in writing technical article and technology development.
4. To internalize ethical principles and code of conduct of a good human being at home, society and at work place.

**Course Outcomes:**

After successful completion of the course students will be able to

1. Learners will be able to recognize the relation between ethics and values pertinent for an engineering professional.
2. Learners will be able to exercise the responsibility for establishing fair and just processes for participation and group decision making
3. Learners will be able to demonstrate an awareness of self-held beliefs and values and how they are altered in interactions with others.
4. Learners will be able to acquire the writing skills necessary to analyse data from research and attribute the source with proper citation.
5. Learners will be competent to incorporate values and ethical principles in social and professional situations.

**DETAILED THEORY SYLLABUS:**

| Sr. No. | Module | Detailed Content | Hrs. |
|---|---|---|---|
| 1. | **Ethics and Values** | Meaning & Concept of Ethics<br>Difference between Ethics and Values<br>Ethical code of conduct | 03 |

Acad Y23-24

| | | | |
|---|---|---|---|
| 2. | **Professional Ethics** | Professional Ethics vs Personal ethics<br>Components of professional ethics<br>Professional values and its importance | 05 |
| 3. | **Ethics and Society** | Relevance of values and ethics in social work<br>Ethical dilemmas<br>Values and ethical principles of social work<br>● Service<br>● Dignity and worth of a person<br>● Importance of Human relationships<br>● Integrity<br>● Competence<br>● Social Justice | 04 |
| 4. | **Ethics in Technical writing** | Documenting sources<br>Presentation of Information<br>Ethics & Plagiarism | 07 |
| 5. | **Ethics and Technology Development** | Risk management and Individual rights<br>Moral issues in development and application of technology<br>Privacy/confidentiality of information<br>Managing Technology to ensure fair practices | 07 |

**Assessments:**

Termwork : 50 marks (Continuous evaluation)

**Books/References:**


1. Martin Cohen, *101 Ethical Dilemmas* Routledge, 2nd edition, 2007.
2. M. Govindarajan, S. Natarajan & V.S. Senthilkumar, *Professional Ethics and Human Values,* Prentice Hall India Learning Private Limited, 2013.
3. Mike W. Martin, *Ethics in Engineering*, McGraw Hill Education; Fourth edition, 2017.


Adm Y 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical/ Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 208 | Analog & Digital Electronics Lab | | 2 | -- | - | 1 | -- | 1 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment (Review) | | | End Sem. Exam | | | | |
| | | 1(10) | 2(10) | Average | | | | | |
| EC 208 | Analog & Digital Electronics Lab | - | - | - | - | 25 | – | 25 | 50 |

**Course Objectives:**

1. To Enhance students' understanding of electronic circuits.
2. To Perform DC and AC analysis of BJT and MOSFET amplifiers.
3. To Learn operational amplifier principles and applications.
4. To Develop skills in IC selection, functionality, and application.
5. To Explain combinational and sequential circuit design using MSI chips.
6. To Introduce logic families, PLDs, and VHDL programming.

**Course Outcomes:**

After successful completion of the course students will be able to

1. Understand construction, characteristics and working of semiconductor devices such as BJT, MOSFET
2. Derive expressions for performance parameters of BJT and MOSFET based Electronic circuits.
3. Derive and determine various performances-based parameters and their significance for Op-Amp and analyze and identify the linear and nonlinear applications of operational amplifiers.
4. Design an application with the use of integrated circuits.
5. Analyze, design and implement Combinational logic circuits, Sequential logic circuits and implementation of various counters using flip flops and MSI chips.
6. Understand basics of VHDL Hardware Description Language and its programming with combinational and sequential logic circuits.

Admy 23-24

**DETAILED LAB SYLLABUS:**

**Software Requirements for AEC :** LTSpice

**Hardware Requirements for AEC:** Breadboard, Transistors, Resistors, Diodes, Connecting wires,Op-amp IC 741, timer IC555

**Software Requirements for DCSD:** VHDL simulation software

**Hardware Requirements for DCSD:** Hardware Kits

| Sr. No. | Detailed Lab/Tutorial Description |
|---|---|
| 1 | To study input and output characteristics of CE configuration |
| 2 | Analyze Integrator using op-amp IC 741 |
| 3 | Design Monostable Multivibrator using IC 555. |
| 4 | To perform DC analysis of voltage divider bias for (BJT) CE amplifier. |
| 5 | To study BJT as CE amplifier.and calculate its voltage gain |
| 6 | Design inverting, non-inverting amplifier and buffer using IC 741 |
| 7 | Design Wein bridge and RC phase shift Oscillator using op-amp IC 741 |
| 8 | Simulation experiment on drain and transfer characteristics of JFET |
| 9 | Simulation experiment on multistage amplifier. |
| 10 | Design High Voltage High Current voltage regulator using IC 723. |
| 11 | Study and design of Combinational circuits. |
| 12 | Study and design of sequential circuits |
| 13 | Implementation of Asynchronous counter using MSI counter IC and flip flops |
| 14 | Implementation of synchronous counter using MSI counter IC and flip flops |
| 15 | VHDL program for Combinational circuits |
| 16 | VHDL program for sequential circuits |

**Lab Assessment:**

Adm Y 23-24

**Term work Assessment :**

At least 8 experiments covering the entire syllabus of AEC and DCSD should be set to have well predefined inference and conclusion. Simulation experiments are also encouraged. The experiments should be student centric and attempt to make experiments more meaningful, interesting and innovative. Term work assessment must be based on the overall performance of the student with every experiment and assignments are graded from time to time.

**Practical/Viva Assessment:**
The practical and oral examination will be based on the entire syllabus.(10 marks for performance and 15 marks for oral)

Adm Y 23-24

# Bachelor of Technology

# In

# Electronics & Computer Science

# (Semester IV)

Adm Y 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical /Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 209 | Engineering Mathematics IV | 03 | -- | - | 03 | -- | - | 03 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | 1 | 2 | Average | | | | | |
| EC 209 | Engineering Mathematics IV | 40 | 40 | 40 | 60 | - | -- | -- | 100 |

**Prerequisite:** Engineering Mathematics I, Engineering Mathematics II and Engineering Mathematics III.

**Course Objectives:**

1. Understand the basic techniques of statistics like correlation, regression, and curve fitting for data analysis, Machine learning, and AI.
2. Acquaint with the concepts of probability, random variables with their distributions and expectations.
3. Understand the concepts of vector spaces used in the field of machine learning and engineering problems.
4. Introduce students to equivalence relations, recurrence relations, Introduce students to graphs, and trees.
5. Understand the concepts of complex integration.
6. Use concepts of vector calculus to analyze and model engineering problems.

**Course Outcomes:**

After successful completion of the course students will be able to

1. Apply the concept of Correlation and Regression to the engineering problems in data science, machine learning, and AI.
2. Illustrate understanding of the concepts of probability and expectation for getting the spread of the data and distribution of probabilities.
3. Apply the concept of vector spaces and orthogonalization process in Engineering Problems.
4. Express recursive functions of other subjects like Data Structures as recurrence relation, Ability to understand use of functions, graphs and trees in programming applications.
5. Use the concepts of Complex Integration for evaluating integrals, computing residues & evaluate various contour integrals.
6. Apply the concepts of vector calculus in real life problems.

Adm Y 23-24

**DETAILED THEORY SYLLABUS:**

| Sr. No. | Module | Detailed Content | Hrs. |
|---|---|---|---|
| 1 | **Correlation, Regression and Curve Fitting,** | Karl Pearson's Coefficient of correlation (r),Spearman's Rank correlation coefficient (R) ,Lines of regression , Fitting of first and second degree curves. | 06 |
| 2 | **Probability, Probability Distributions** | Conditional probability, Total Probability and Baye's Theorem, Discrete and Continuous random variables, Probability mass and density function, Probability distribution for random variables, Expectation, Variance, Binomial distribution ,Poisson distribution, Normal distribution | 06 |
| 3 | **Linear Algebra : Vector Spaces** | Vectors in R^n , norm, dot product, The Cauchy Schwarz inequality, Unit vector ; Linear combinations, linear Dependence and Independence, QR decomposition ; Orthogonal projection, Orthonormal basis, Gram-Schmidt process for vectors ; Vector spaces over real field $R^n$ to $R^m$. | 06 |
| 4 | **Graphs and Trees** | Types of Graphs, Isomorphism Of Graphs, Subgraphs, Types of Graphs, Complement of Graph, Connected Graphs, Eulerian And Hamiltonian Graphs, Trees, Binary Trees, Minimum Spanning Tree, Kruskal's Algorithm | 07 |
| 5 | **Lattice Theory & Recurrence relation** | Poset, Hasse Diagram, Lattices, Special Types of Lattices, Solving Recurrence relation, Linear Homogenous Recurrence relation with constant coefficients, Introduction to Non-Homogenous Recurrence relation | 06 |
| 6 | **Complex Integration and Vector Integration** | Line Integral, Cauchy's Integral theorem for simple connected regions (without proof), Cauchy's Integral formula (without proof).<br>Taylor's and Laurent's series (without proof).<br>Definition of Singularity, Zeroes, poles of f(z), Residues, Cauchy's Residue Theorem (without proof)<br>Vector integral: Line Integral, Green's theorem in a plane (Without Proof),<br>Stokes' theorem (Without Proof) only evaluation. Gauss' divergence theorem (Without Proof) | 08 |

Adm 23-24

**Theory Assessments:**

1. **Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.

**2. End Sem Theory Examination:**

- Question paper will consist of 4 questions, each carrying 20 marks.
- Total 3 questions need to be solved.
- Q.1 will be compulsory, based on the entire syllabus.
- Remaining questions will be randomly selected from all the modules.

Weightage of marks should be proportional to the number of hours assigned to each module.

**Books/References:**


1. Probability, Statistics and Random Processes, T. Veerarajan, Mc. Graw Hill education.
2. Vector Analysis, Murray R. Spiegel, Schaum Series.
3. Beginning Linear Algebra Seymour Lipschutz Schaum's outline series, Mc-Graw Hill Publication.
4. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Narosa publication.
5. Discrete Mathematical Structures"Bernard Kolman, Robert C. Busby ,Sharon Cutler Ross, Nadeem-ur-Rehman, " Pearson Education.
6. Discrete Mathematical Structures: Theory and Applications, D.S. Malik and M.K. Sen: Cengage Learning, 2004.
7. Higher Engineering Mathematics B. V. Ramana, Tata Mc-Graw Hill Publication.
8. Advanced Engineering Mathematics Wylie and Barret, Tata Mc-Graw Hill.
9. Advanced engineering mathematics H.K. Das, S . Chand, Publications.
10. Discrete Mathematics with Applications, Thomas Koshy, Elsevier, 2005, Reprint 2008.


Adm AY 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical/Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 210 | Analysis of Algorithms | 03 | 02 | – | 03 | 01 | – | 04 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | 1 | 2 | Average | | | | | |
| EC 210 | Analysis of Algorithms | 40 | 40 | 40 | 60 | 25 | 25 | -- | 150 |

**Prerequisite:** Data Structure

**Course Objectives:**

1. To conceptualize learners with mathematical models for analysis of algorithm
2. To understand and solve problems using various algorithmic design strategies.
3. To apply algorithm strategies to real life problems.

**Course Outcomes:**

After successful completion of the course students will be able to

1. Understand notations used for time complexity analysis of algorithms.
2. Explain Divide and Conquer Approach with its applications.
3. Understand Dynamic Programming Approach for finding the shortest path.
4. Apply the concept of Greedy Method Approach with different applications.
5. Use Backtracking and Branch-and-bound Method for various applications.
6. Understand the concept of Number Theoretic, Graph Theoretic and Non-deterministic polynomial time algorithms

AY 23-24

**DETAILED THEORY SYLLABUS:**

| Sr. No. | Module | Detailed Content | Hrs. |
|---|---|---|---|
| 1 | **Introduction to algorithms and analysis of algorithm** | Brief introduction of Algorithms and its design methods. Analysis of Algorithm - Time & Space Complexity, Asymptotic Analysis in best, average and worst case & Asymptotic Notations (O, Ω, θ, w, o ). Brief introduction of Randomized Algorithms. | 07 |
| 2 | **Divide and Conquer Approach** | Recurrence Equations, Solution of Recurrence equations - Master Theorem, Recurrence Tree method & Substitution method.<br>General Structure of a Divide and Conquer Algorithm, Applications - Analysis of Merge & Quick sort Algorithms. Strassen's Matrix Multiplication Algorithm & Finding the closest pair of points in a 2D plane Algorithm. | 06 |
| 3 | **Dynamic Programming Approach** | General Method, Applications - Matrix chain multiplication, Optimal binary search trees, Single Source Shortest Path - Bellman-Ford Algorithm, Dijkstra's algorithm. All pairs shortest path problem - Floyd-Warshall Algorithm, Travelling salesperson problem. | 08 |
| 4 | **Greedy Method Approach** | General Method, Applications - Job sequencing with deadlines, fractional & 0/1 knapsack problem, Minimum cost spanning trees - Prims & Kruskal's Algorithms. | 08 |
| 5 | **Backtracking and Branch-and-bound** | Backtracking - General Method, Graph coloring.<br>Branch and Bound - General Method, Applications - 0/1 knapsack problem - LC Branch and Bound solution, FIFO Branch and Bound solution. | 05 |
| 6 | **Selected algorithms and Non-deterministic polynomial time algorithms** | Number Theoretic - Euclid's algorithm for GCD and it's time complexity analysis,<br>Graph Theoretic - Johnson's algorithm for All pair Shortest Path problem<br>Computational Complexity classification of problem: Brief introduction of non deterministic algorithms, Complexity classes - P, NP. | 05 |

**DETAILED LAB SYLLABUS:**

**Lab Prerequisite:**

**Software Requirements: C/Python/C++**

| Sr. No. | Detailed Lab/Tutorial Description |
|---|---|
| 1 | Implement Merge and Quick sort algorithms. |
| 2 | Implement Bellman-Ford algorithm. |
| 3 | Implement Floyd-Warshall algorithm. |
| 4 | Implement Dijkstra's algorithm for the single source shortest path problem on a given weighted graph. |
| 5 | Implement Prim/Kruskal algorithm for finding a minimum cost spanning tree of a given input graph. |
| 6 | Implement a backtracking based algorithm for vertex coloring of a given graph. |
| **7** | Implement Johnson's algorithm for shortest paths, for a given graph. |
| 8 | Implement a randomized algorithm for searching an element in an unsorted array and derive its expected time complexity. |
| 9 | Implement Euclid's algorithm to calculate GCD of a given set of n>2 natural numbers. |

**Theory Assessments:**

**1. Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.

**2. End Sem Theory Examination:**

- Question paper will consist of 4 questions, each carrying 20 marks.
- Total 3 questions need to be solved.
- Q.1 will be compulsory, based on the entire syllabus.
- Remaining questions will be randomly selected from all the modules.

Weightage of marks should be proportional to number of hours assigned to each module.

**Lab Assessment:**

**1.Termwork Assessment:**

Term work should consist of all the work done in tutorials and assignments. The final certification and acceptance of term work ensures satisfactory performance throughout all the assigned work.

**2. Oral/Practical Assessment:** Practical & Oral Exams should be conducted based on syllabus and practicals conducted.

**Text Books:**

Adm Y 23-24

1. Ellis Horowitz,Satraj Sahni and Rajasekharam, Fundamentals of Computer Algorithms, Galgotia publications pvt. Ltd.
2. Parag Himanshu Dave, Himanshu Bhalchandra Dave, Design and Analysis Algorithms - Publisher: Pearson

**Reference Books:**

1. T.H.Cormen, C.E.Leiserson, R.L.Rivest, C. Stein, Introduction to Algorithms, 2nd edition, Prentice-Hall India, 2001.
2. J. Kleinberg and E. Tardos, Algorithm Design, Pearson International Edition, 2005.

Adm Y 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical/ Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 211 | Basics of VLSI Design | 03 | 02 | -- | 03 | 01 | -- | 04 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | 1 | 2 | Average | | | | | |
| EC 211 | Basics of VLSI Design | 40 | 40 | 40 | 60 | 25 | -- | 25 | 150 |

**Course Objectives:**

1. To teach fundamental principles of VLSI circuit design and layout techniques.
2. To highlight the circuit design issues in the context of VLSI technology.
3. To explain different scaling effects.
4. To study CMOS gates and effect of W/L ratio.
5. To study dynamic gates and circuit realization using pass transistors.
6. To design semiconductor memories and its importance.

**Course Outcomes: Upon successful completion of the course students will be able to**

1. Apply the knowledge to demonstrate a clear understanding of choice of technology and technology scaling.
2. Explain the design of MOSFET Inverters.
3. Analyze and design MOS based circuits design styles.
4. Understand CMOS gates and effect of W/L ratio.
5. Understand dynamic gates and circuit realization using pass transistors.
6. Understand the design of Semiconductor Memories.

**Prerequisite:** Analog Electronics Circuits, Digital Circuits and System Design(DCSD)

Adm Y 23-24

**DETAILED THEORY SYLLABUS:**

| Sr. No. | Module | Detailed Content | Hrs |
|---|---|---|---|
| 1 | **Technology Comparison, MOSFET Scaling** | Comparison of BJT, NMOS and CMOS technology<br>Types of scaling, MOSFET Models, MOSFET capacitances | 05 |
| 2 | **MOSFET Inverters** | **Circuit Analysis:** Static and dynamic analysis (Noise, propagation delay and power dissipation) of resistive load, E mode MOSFET load, D mode MOSFET load inverter and CMOS inverter, comparison of all types of MOS inverters, design of CMOS inverters | 07 |
| 3 | **Universal gates, Complex circuits using MOSFETs** | **Logic Circuit Design**: Analysis and design of 2-I/P NAND and NOR using equivalent CMOS inverter, W/L ratio, Complex circuits. | 07 |
| 4 | **MOS Circuit Design Styles** | **Design Styles:** Static CMOS, pass transistor logic, transmission gate, Pseudo NMOS, Domino, NORA, Zipper, C2MOS, sizing using logical effort | 08 |
| 5 | **Circuit Realization using MOSFETs** | **Circuit Realization:** SR Latch, JK FF, D FF, 1 Bit Shift Register, MUX, decoder using above design styles | 06 |
| 6 | **Semiconductor Memories** | **SRAM:** ROM Array, SRAM (operation, design strategy, leakage currents, read/write circuits), DRAM (Operation, leakage currents, refresh operation), Flash memory- NOR flash, NAND flash. | 06 |

**DETAILED LAB SYLLABUS:**

**Software Requirements:** TINA**,** NGSpice, Microwind

| Sr. No. | Detailed Lab Description |
|---|---|
| 1 | Effect of parasitic capacitance and threshold voltage on output of NMOS inverter with resistive load. |
| 2 | Circuit characteristics and performance estimation of NMOS inverter with resistive load.<br>1) Verification of $V_{OH}$ level for different values of load resistance. |

Adm Y23-24

| | |
|---|---|
| | 2) Find rise time for different values of load resistance. |
| 3 | Circuit characteristics and performance estimation of NMOS inverter with Enhancement mode MOSFET load. |
| 4 | Circuit characteristics and performance estimation of NMOS inverter with Depletion mode N channel MOSFET as a load. |
| 5 | Circuit characteristics and performance estimation of CMOS inverter.<br>1) Verification of $V_{OH}$ and $V_{OL}$ levels.<br>2) Comparison of rise and fall times for different values of W/L ratio of pull up and pull down devices. |
| 6 | Circuit characteristics and performance estimation of CMOS Dynamic 2 Input NAND Gate.<br>1) Verification of $V_{OH}$ and $V_{OL}$ levels for various input possibilities.<br>2) Verification of precharge and evaluate condition for different inputs.<br>3) Verification of charge leakage problem. |
| **7** | Design of 4:1 MUX using pass transistor logic and transmission gates. |
| 8 | Design of 6T SRAM using Microwind dsch3.1. |

**Theory Assessments:**

1. **Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.
2. **End Sem Theory Examination:**

- Question paper will consist of 4 questions, each carrying 20 marks.
- Total 3 questions need to be solved.
- Q.1 will be compulsory, based on the entire syllabus.
- Remaining questions will be randomly selected from all the modules.

Weightage of marks should be proportional to number of hours assigned to each module.

**Lab Assessments:**

Term work should consist of 8 experiments.

Journal must include at least 3 assignments.

Adm Y23-24

**Term work Assessment:**

Total 25 Marks (Experiments: 10-marks, Assignments: 10-marks, Attendance Theory & Practical: 05-marks)

**Oral/Viva Assessment**:

Based on the above contents and entire syllabus.

**Text Books:**


1. Sung-Mo Kang and Yusuf Leblebici, "CMOS Digital Integrated Circuits Analysis and Design", Tata McGraw Hill, 3rd Edition.
2. Jan M. Rabaey, Anantha Chandrakasan and Borivoje Nikolic, "Digital Integrated Circuits: A Design Perspective", Pearson Education, 2nd Edition.


**References**


1. Etienne Sicard and Sonia Delmas Bendhia, "Basics of CMOS Cell Design", Tata McGraw Hill, First Edition. 2. Neil H. E. Weste, David Harris and Ayan Banerjee, "CMOS VLSI Design: A Circuits and Systems Perspective", Pearson Education, 3rd Edition.

2. Debaprasad Das, "VLSI Design", Oxford, 1st Edition. 6. Kaushik Roy and Sharat C. Prasad, "Low-Power CMOS VLSI Circuit Design", Wiley, Student Edition.


Adm Y 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical/Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 212 | System Software & Operating Systems | 03 | -- | -- | 03 | -- | -- | 03 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | 1 | 2 | Average | | | | | |
| EC 212 | System Software & Operating Systems | 40 | 40 | 40 | 60 | -- | -- | -- | 100 |

**Prerequisite:** Basic knowledge of Data structures and Computer architecture, Any programming language

**Course Objectives:**

1. To understand the role and functioning of various system programs over application programs.
2. To understand basic concepts and designing of assembler and Macro processor.
3. To understand the role of loaders, linkers and Compilers.
4. To introduce basic concepts and functions of operating systems.
5. To introduce the concept of a process, thread and its management, Inter-process communication (IPC) and also understand the concepts of process synchronization and deadlock.
6. To understand the concepts and implementation of memory management policies, virtual memory and functions of Operating Systems for device management.

**Course Outcomes:**

After successful completion of the course students will be able to

1. Identify the relevance of different system programs.
2. Explain various data structures used for assembler and macro processor design.
3. Understand the functions of linkers, loaders and fundamentals of compiler design also identify the relationships among different phases of the compiler.
4. Understand the objectives, functions and structure of OS.
5. Analyze the concept of process management and evaluate performance of process scheduling algorithms.
6. Apply and analyze different techniques of memory management and I/O management.

AGE Y 23-24

**DETAILED THEORY SYLLABUS:**

| Sr. No. | Module | Detailed Content | Hrs. |
|---|---|---|---|
| 1 | **Introduction to System Software** | Concept of System Software, Introduction to various system programs such as Assembler, Macro processor, Loader, Linker, Compiler, Interpreter, Device Drivers, Operating system, Editors, Debuggers. | 03 |
| 2 | **Assemblers and Macro Processors** | Elements of Assembly Language programming, Assembler Design: Introduction to single pass Assembler Design for Hypothetical machines, data structures used.<br>Macro definition and call, parameterized, conditional Macro, Design of Two pass macro processor for Hypothetical machines, data structures used. | 08 |
| 3 | **Linkers, Loaders and Compilers** | Functions of loaders, Absolute loader/Compile and Go loader, Phases of compilers:Lexical Analysis, Syntax analysis, SR Parser, Introduction to semantic analysis, Intermediate Code Generation:Types of Intermediate codes, Code optimization techniques, Introduction to Code Generation. | 08 |
| 4 | **Overview of operating System** | Introduction, Objectives, Functions and Types of Operating System, Operating System Services and Interface; Operating system structures: Layered, Monolithic and Microkernel. | 04 |
| 5 | **Process Management** | Concept of a Process, Process States, Operation on Process Uniprocessor Scheduling-Types: Preemptive and Non-preemptive, scheduling algorithms Threads: Definition and Types, Concept of Multithreading,<br>Inter-Process Communication, Process Synchronization, Mutual Exclusion: ,Semaphores, Producer Consumer problem, Principles of Deadlock: Conditions Deadlock Handling Mechanism. | 08 |
| 6 | **Memory Management and I/O Management** | Basic Concepts of Memory Management; Memory Allocation Techniques, Paging, TLB, Segmentation, Virtual Memory; Demand Paging, Page Replacement Algorithms,<br>I/O Devices, Disk Scheduling algorithm: FCFS, SSTF, SCAN, CSCAN, LOOK, C- LOOK, Linux I/O. | 08 |

**Theory Assessments:**

1. **Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.

AcadY 23-24

2. **End Sem Theory Examination:**

- Question paper will consist of 4 questions, each carrying 20 marks.
- Total 3 questions need to be solved.
- Q.1 will be compulsory, based on the entire syllabus.
- Remaining questions will be randomly selected from all the modules.

Weightage of marks should be proportional to the number of hours assigned to each module.

**Text Books:**

1. D. M Dhamdhere: Systems programming, Tata McGraw Hill.

2. A. V. Aho, R. Shethi, Monica Lam , J.D. Ulman : Compilers Principles, Techniques and Tools, Pearson Education , Second Edition.

3. William Stallings, Operating System: Internals and Design Principles, Prentice Hall, 8th Edition, 2014, ISBN-10: 0133805913 鈥?ISBN-13: 9780133805918 .

4. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, John Wiley & Sons , Inc., 9th Edition, 2016, ISBN 978-81-265-5427-0

**References:**

1. Compiler construction : principles and practices , Kenneth C.Louden ,CENGAGE Learning.
2. System software : An introduction to system programming , Leland L. Beck, Pearson.
3. Principles of Operating Systems, Naresh Chauhan, First Edition , Oxford university press.
4. Achyut Godbole and Atul Kahate, Operating Systems, McGraw Hill Education, 3rd Edition.

Adm Y 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical /Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 213 | Microprocessor & Microcontrollers | 03 | 02 | -- | 03 | 01 | -- | 04 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | 1 | 2 | Average | | | | | |
| EC 213 | Microprocessor & Microcontrollers | 40 | 40 | 40 | 60 | 25 | - | 25 | 150 |

**Prerequisite:** Digital System Design

**Course Objectives:**

1. To understand the basic concepts of Microprocessor based systems.
2. To understand the architecture and instruction set of 8-bit Microcontroller 8051.
3. To write assembly / C programs for 8051 Microcontroller.
4. To understand peripheral devices and their interfacing with 8051 Microcontroller.
5. To understand various applications of 8051microcontroller.
6. To understand architecture of 32-bit Microcontroller ARM Cortex M3.

**Course Outcomes:**

After successful completion of the course students will be able to

1. Identify the features of microcontrollers (8051 & ARM Cortex M3)
2. Understand the architecture and aspects of 8051& Cortex M3 microcontroller.
3. Interface microcontroller with hardware for given application
4. Write and execute assembly or C language programs for given application.
5. Explain the Interrupt system, operation of Timers/Counters and Serial port of 8051
6. Develop small microcontroller based applications.

**DETAILED THEORY SYLLABUS:**

| Sr. No. | Module | Detailed Content | Hrs. |
|---|---|---|---|
| 1. | **Introduction to Microprocessor System.** | 1.1 Microprocessor based system: CPU, I/O Devices, Clock, Memory, Concept of Address, Data and Control Bus.<br>1.2 Features of 8086 Microprocessor.<br>1.3 Comparison between Microprocessor and Microcontroller.<br>1.4 Concept of Harvard & Von Neumann Architecture.<br>1.5 pipelined operation. | 04 |

AY 23-24

| | | | |
|---|---|---|---|
| 2 | **8051 Microcontroller Architecture** | 2.1 8051 Features & its architecture (ALU, PC, DPTR, PSW, Internal RAM, Internal ROM, Latch, SFRs, General purpose registers, Timer/Counter, Interrupt, Ports).<br>2.2 Pin configuration of 8051 Microcontroller.<br>2.3 Memory organization (Program and Data memory Map) | 04 |
| 3. | **8051 Microcontroller assembly language programming** | 3.1 Addressing modes of 8051.<br>3.2 Assembler directives of 8051.<br>3.3 Instruction Set: Data transfer, Arithmetic, Logical, Branching.<br>3.4 Programming concepts: Looping , Counting, sorting and Indexing, Data manipulation, Masking.<br>3.5 Programs related to: arithmetic, logical, Branch & delay. | 08 |
| 4. | **Internal Hardware of 8051 Microcontroller & Programming** | 4.1 I/O port structure and programming.<br>4.2 Timer/Counter and programming..<br>4.3 Serial port and programming.<br>4.4 Interrupts and programming.<br>4.5 Power saving modes of 8051: Power down and idle mode. | 08 |
| 5. | **8051 Interfacing & Applications** | 6.1 Display interfacing: 7-segment LED display, 16x2 generic alphanumeric LCD display.<br>6.2 Analog devices interfacing: 8-bit ADC and DAC<br>6.3 Motor interfacing: Dc motor & Stepper motor.<br>6.4 Waveform (Ramp, triangular & Sine wave) generation program using DAC. | 08 |
| 6. | **Advanced Microcontroller Architecture (ARM CORTEX-M3)** | 6.1 Comparison of CISC & RISC architectures.<br>6.2 Overview of ARM family.<br>6.3 ARM Cortex-M3 architecture,.<br>6.4 Programmer's model: Operation Modes and States, registers, special registers, Application Program Status Register- Integer status flags, Q status flag, GE bits.<br>6.5 Memory system: Features and memory map<br>6.6 Exceptions and Interrupts - Nested vectored interrupt controller. | 07 |

**DETAILED LAB SYLLABUS:**

**Lab Prerequisite:** Digital System Design

**Hardware Requirements:** Experiments can be conducted on Assembler, Emulator

**Software Requirements:** Hardware kits

| Sr. No. | Detailed Lab/Tutorial Description |
|---|---|
| 1 | Introduction to 8086 microprocessor kit and assembler. |
| 2 | To write an assembly language program to perform Arithmetic and Logical Operations using 8051 microcontroller. |
| 3 | To write an assembly language program to transfer of data bytes between Internal and External Memory using 8051 microcontroller. |

AY 23-24

| | |
|---|---|
| 4 | To write an assembly language program to perform experiments based on General Purpose Input-Output & Timers. |
| 5 | Program for Serial communication of 8051 using UART. |
| 6 | Programs for Interfacing of Stepper Motor/DC motor with 8051 microcontroller. |
| 7 | Programs for generating waveform (Square, Triangular, Sine wave) with 8051 microcontroller. |
| 8 | Programs for Interfacing of LCD with 8051 |
| 9 | Mini project based on any application related to 8051 microcontroller. |

**Theory Assessments:**

**1. Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.

**2. End Sem Theory Examination:**

- Question paper will consist of 4 questions, each carrying 20 marks.
- Total 3 questions need to be solved.
- Q.1 will be compulsory, based on the entire syllabus.
- Remaining questions will be randomly selected from all the modules.
- Weightage of marks should be proportional to the number of hours assigned to each module.

**Lab Assessment:**

**1. Term work Assessment:**

08 Experiments covering the entire syllabus must be given during the "Laboratory session batch wise". Computation/simulation based experiments are also encouraged. The experiments should be student centric and attempts should be made to make experiments more meaningful, interesting and innovative. Application oriented one mini-project can be conducted for a maximum batch of at least 04 students.

**Text Books:**


1. Microprocessor and Interfacing: By Douglas Hall (TMH Publication)
2. M. A. Mazidi, J. G. Mazidi and R. D. Mckinlay, "The 8051 Microcontroller & Embedded systems", Pearson Publications, Second Edition 2006.
3. C. Kenneth J. Ayala and D. V. Gadre, "The 8051 Microcontroller & Embedded system using assembly & 'C' ", Cengage Learning, Edition 2010.
4. Joseph Yiu,"The Definitive Guide to ARM CORTEX-M3 & CORTEX-M4 Processors", Elsevier, 2014, 3rd Edition.


**Reference Books:**


1. 8086 Microprocessor Programming and Interfacing the PC: By Kenneth Ayala (West Publication).
2. Microcomputer Systems: 8086/8088 family Architecture, Programming and Design: By Liu & Gibson (PHI Publication).
3. Satish Shah, "The 8051 Microcontrollers", Oxford publication first edition 2010.
4. "MCS@51 Microcontroller, Family users Manual" Intel.
5. David Seal, "ARM Architecture", Reference Manual (2nd Edition), Publisher Addison Wesley.


ARM Y23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical /Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 214 | Entrepreneurship | 02 | - | - | 02 | - | - | 02 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | 1 | 2 | Avg. of 2 | | | | | |
| EC 214 | Entrepreneurship | 20 | 20 | 20 | 40 | - | - | - | 60 |

**Course Objectives**:

1. To understand the basic concepts of entrepreneurship.
2. To understand the role of entrepreneurship in economic development
3. To understand the importance of opportunity recognition and internal and external analyses to the success of a business venture
4. To enable the learners to know the factors contributed in failure of the enterprise

**Course Outcomes**:

1. Analyse the business environment in order to identify business opportunities
2. Identify the elements of success of entrepreneurial ventures
3. Evaluate the effectiveness of different entrepreneurial strategies,
4. Interpret their own business plan
5. Identify and understand marketing plan and strategies
6. Identify the causes of entrepreneurial failure

Adm Y 23-24

**Detailed Theory Syllabus:**

| Module No | Detailed Content | Hours |
|---|---|---|
| 1 | Conceptual definition of entrepreneurs and entrepreneurship, Advantages and Disadvantages of Being an Entrepreneur, Entrepreneurial motivation, Entrepreneurial characteristics | 8 |
| 2 | Recognizing, assessment and Exploiting the Opportunity, Conducting Internal and External Analyses, Determining the Feasibility of the Concept, Selecting a Marketing Strategy | 6 |
| 3 | Entrepreneurial Business Types<br>A. Overview of Franchising and Their Advantages and Disadvantages<br>B. Overview of Buyouts & Their Advantages and Disadvantages<br>C. Overview of Family Businesses and Their Advantages and Disadvantages | 6 |
| 4 | The Overall Business Plan, Purpose of the Business Plan, Components of the Business Plan, Presentation of the Business Plan, Matching the Business Plan to the Needs of the Firm | 6 |
| 5 | The Marketing Plan, conducting a Market Analysis, Understanding the Target Market, Reaching the Target Market through Locale and Engagement | 8 |
| 6 | Entrepreneurial failure, early stage failure, late stage failure | 6 |

**Assessment:**
Internal Assessment:20 marks

End Semester Examination: 40 Marks

**Books and References:**


1. Fundamentals of Entrepreneurship by H. Nandan, PHI
2. Entrepreneurship by Robert Hisrich, Michael Peters, Dean Shepherd, Sabyasachi Sinha, Mc Graw Hill
3. Why startups fail: A new roadmap for entrepreneurial success by Tom Eisenmann


Adm Y 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical/Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 215 | System Software & Operating Systems Lab | - | 02 | -- | - | 01 | -- | 01 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | 1 | 2 | Average | | | | | |
| EC 215 | System Software & Operating Systems Lab | - | - | - | - | 25 | -- | 25 | 50 |

**Prerequisite:** Basic knowledge of Data structures and Computer architecture, Any programming language

**Course Objectives:**

1. To understand the role and functioning of various system programs over application programs.
2. To understand basic concepts and designing of assembler and Macro processor.
3. To understand the role of loaders, linkers and Compilers.
4. To introduce basic concepts and functions of operating systems.
5. To introduce the concept of a process, thread and its management, Inter-process communication (IPC) and also understand the concepts of process synchronization and deadlock.
6. To understand the concepts and implementation of memory management policies, virtual memory and functions of Operating Systems for device management.

**Course Outcomes:**

After successful completion of the course students will be able to

1. Identify the relevance of different system programs.
2. Explain various data structures used for assembler and macro processor design.
3. Understand the functions of linkers, loaders and fundamentals of compiler design also identify the relationships among different phases of the compiler.
4. Understand the objectives, functions and structure of OS.

AY 23-24

5. Analyze the concept of process management and evaluate performance of process scheduling algorithms.
6. Apply and analyze different techniques of memory management and I/O management.

**DETAILED LAB SYLLABUS:**

**Lab Prerequisite:** Any programming language, Knowledge on Operating system principles.

**Hardware Requirements:** 2GB RAM,PC i3 processor and above

**Software Requirements:** C, IDE/Compiler (Geany). Linux Operating System

| Sr. No. | Detailed Lab/Tutorial Description |
|---|---|
| 1 | Implementation of File handling program. |
| 2 | Implementation of single pass Macro Processor. |
| 3 | Implementation of Lexical analysis phase of compilers. |
| 4 | Implementation of Parser (Any one). |
| 5 | Implementation of Intermediate code generation phase of compilers. |
| 6 | Implementation of code generation phase of compilers. |
| 7 | Explore usage of basic and advanced Linux Commands. For eg: (mkdir, chdir, cat, ls, chown, chmod, chgrp, ps etc). |
| 8 | Explore the file and process management system calls. |
| 9 | Write a program to demonstrate the concept of non-preemptive and preemptive scheduling algorithms. |
| 10 | Write a program in C demonstrate the concept of page replacement policies. |

**Lab Assessment:**

**1.Term work Assessment:**
Term work should consist of 8 experiments. Journal must include at least 2 assignments on content of theory and practical of "System Software & Operating Systems".The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. Total 25 Marks (Experiments: 15-marks, Attendance Theory & Practical: 05-marks, Assignments: 05-marks).

**2.Oral/Practical Assessment:**

Based on the experiments and entire syllabus.

Aim AY 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical /Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 291 | Programming Lab I ( Java Programming) | | 1#+2 | -- | - | 1 | -- | 1 |

1# to be taken class wise

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment (Review) | | | End Sem. Exam | | | | |
| | | 1(10) | 2(10) | Average | | | | | |
| EC 291 | Programming Lab I ( Java Programming) | - | - | - | - | 25 | – | 25 | 50 |

**Course Objectives:**

1. To understand Java's evolution, architecture, IDE usage, and basic I/O operations for program development.
2. To apply object-oriented programming principles for designing modular, maintainable, and efficient software solutions.
3. To explore inheritance, polymorphism, and advanced OOP features for enhancing code reusability and flexibility.
4. To utilize Java packages and JAR files for organizing code, encapsulation, and creating reusable libraries.
5. To manage exceptions and implement multithreaded applications with synchronization and concurrency concepts.
6. To design interactive GUIs and implement graphics programming for modern application development.

**Course Outcomes:**

After successful completion of the course students will be able to

1. Demonstrate proficiency in Java programming using its architecture, IDEs, and I/O operations.
2. Apply object-oriented programming techniques to solve real-world problems effectively.
3. Implement advanced OOP concepts like inheritance and polymorphism for scalable software development.

Adm Y 23-24

4. Create modular and reusable code using Java packages and libraries adhering to industry standards.
5. Develop robust applications by implementing exception handling and multithreading techniques.
6. Design and build interactive graphical user interfaces using JavaFX, Swing, and Java2D.

**DETAILED SYLLABUS:**

| Sr. No. | Module | Detailed Lab/Tutorial Description | No of Hours |
|---|---|---|---|
| 1 | Introduction to Java | 1.1 Java History, Java Features, **Java Editions (SE, EE, ME)**, 1.2 Java Virtual Machine **and Its Architecture**, 1.3 Data Types and Size 1.4 Java Program Development, **"Java IDEs"** like IntelliJ IDEA, Eclipse, or NetBeans 1.5 Java Source File Structure, Compilation, Executions. 1.6 **Basic I/O operations (reading from and writing to files or console)..** | 3 |
| 2 | Object-Oriented Programming Fundamentals | 2.1 Core OOP Concepts: Classes, Objects, Object References, Access Modifiers (private, protected, public), and static 2.2 Constructors and Initialization Blocks: Purpose, overloading, and use in object creation.2.3 Abstract Classes and Interfaces: Abstract methods, abstract classes, and Interfaces (default and static methods in Java 8+). 2.4 Object Class Basics: Methods like toString(), equals(), and hashCode(). | 5 |
| 3 | Advanced OOP - Inheritance and Polymorphism | 3.1 Inheritance: Benefits, Types (Single, Multilevel, Hierarchical), and Role of Constructors in Inheritance. 3.2 Polymorphism: Method Overloading (compile-time) and Method Overriding (runtime). 3.3 Advanced Features: Use of super, final for class/method restriction, Object Cloning, and Reusability Best Practices. | 5 |
| 4 | Packages | 4.1 Organizing Classes and Interfaces: Role of packages in modular design and logical grouping. 4.2 Access Protection: Use of packages for encapsulation and controlled access to classes/methods. 4.3 Creating and Using Packages: Defining packages, setting up classpath, compiling with packages. 4.4 Working with JAR Files: Creating reusable libraries (JAR files), importing packages, and static imports. 4.5 Best Practices: Naming conventions and guidelines for creating packages in professional environments. | 4 |

Adm 2023-24

| | | | |
|---|---|---|---|
| 5 | Exception Handling & Multithreading | 5.1 Introduction to Exceptions: Difference between Exceptions and Errors, Types of Exceptions (Checked and Unchecked). 5.2 Exception Handling Mechanisms: Control flow in exceptions, use of try, catch, finally, throw, and throws. 5.3 Custom Exceptions: Defining and handling user-defined exceptions. 5.4 Multithreading Basics: Introduction to threads, lifecycle of a thread, and creating threads using Thread class and Runnable interface. 5.5 Thread Management: Thread methods (start(), sleep(), join(), etc.), thread synchronization, and handling thread exceptions. 5.6 Concurrency Concepts: Basic introduction to thread safety and inter-thread communication. | 5 |
| 6 | Modern GUI Development and Graphics Programming in Java | **6.1 GUI Programming with JavaFX & Swing:** Introduction to modern GUI development using **Swing** and **JavaFX**, covering basic components like buttons, labels, and text fields, with event handling for user interactions. **6.2 Layouts & Design:** Use of layout managers in **Swing** (FlowLayout, BorderLayout) and **JavaFX** (HBox, VBox, GridPane) for creating responsive UIs. **6.3 Graphics Programming:** Drawing shapes, colors, and simple animations using **Java2D API** for graphics programming. | 4 |

Adm Y 25-24

**DETAILED LAB SYLLABUS:**

**Software Requirements:** Netbeans:https://netbeans.org/downloads/ J-Edit/J-Editor/Blue J

| Sr. No. | Detailed Lab/Tutorial Description |
|---|---|
| 1 | Write a Java program to demonstrate basic file and console I/O operations, such as reading input from the user and writing output to a file. |
| 2 | Create a Java program to define a class with attributes and methods. Implement constructors (default and parameterized) and demonstrate the use of access modifiers (private, public, protected). |
| 3 | Develop a program using an abstract class and an interface with Java features like default and static methods. Show polymorphism with overriding methods. |
| 4 | Design a program to demonstrate single and multilevel inheritance. Implement method overriding to achieve runtime polymorphism and use the super keyword. |
| 5 | Write a program to demonstrate object cloning in Java. Show how to create deep copies of objects and reuse methods for efficient design. |

| | |
|---|---|
| 6 | Create a Java project with multiple packages to organize classes logically. Include encapsulation and access protection, compile with classpath settings, and create a JAR file for reuse. |
| 7 | Write a program to demonstrate the use of try-catch-finally, throw, and throws. |
| 8 | Develop a multithreaded program to simulate a real-world scenario . |
| 9 | Build a GUI application using JavaFX or Swing. Implement buttons, labels, text fields, and event handling. Incorporate basic Java2D API features to draw shapes and create a simple animation. |
| 10 | Mini Project |

**Guidelines for Mini Project**

- Students shall form a group of 3 to 4 students, while forming a group shall not be allowed less than three or more than four students, as it is a group activity.
- Students should do surveys and identify needs, which shall be converted into problem statements for mini projects in consultation with faculty supervisor/head of department/internal committee of faculties.
- Students shall submit an implementation plan, which will cover weekly activity of mini projects.
- A log book to be prepared by each group, wherein the group can record weekly work progress, guide/supervisor can verify and record notes/comments.
- Faculty supervisor may give inputs to students during mini project activity; however, focus shall be on self-learning.
- Students in a group shall understand the problem effectively, propose multiple solutions and select the best possible solution in consultation with the guide/ supervisor. The solution to be validated with proper justification and report to be compiled in standard format.

**Lab Assessment:**

**1.Term work Assessment:**

For performance experiments : **10-**Marks

Attendance : 05 Marks

Quality of Project report : **10** Marks

**2.Oral/Practical Assessment:**

Viva exam will be based on the experiments and project implemented in the semester.

Adm y 23-24

## Program Structure for
## Bachelor of Technology in Electronics & Computer Science

### Semester V

| Course Code | Course Name | Category | Course Component | Teaching Scheme (Contact Hours) | | Credits Assigned | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | Pract/ Tuts | Theory | Pract / Tuts | Total |
| EC 301 | Signals & Systems | PCC | TL | 3 | 1 | 3 | 1 | 4 |
| EC 302 | Computer Networks | PCC | TL | 3 | 2 | 3 | 1 | 4 |
| EC 303 | Professional Communication and Ethics II | AEC | LC | 1 | 2 | 1 | 1 | 2 |
| EC 304 | Software Engineering | MDM | T | 3 | - | 3 | - | 3 |
| EC 3xx | Department Level Optional Course I | PEC | TL | 3 | 2 | 3 | 1 | 4 |
| IL 3xx | Institute Level Optional Course I | Open Elective (OE) | FT | 3 | - | 3 | - | 3 |
| EC 391 | Programming Lab II (Web Programming) | Skill Courses | LPC | 1 | 2 | 1 | 1 | 2 |
| **Total** | | | | **17** | **09** | **17** | **5** | **22** |

| Course Code | Course Name | Category | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Theory | | | | | Term Work | Pract / Oral | Total |
| | | | Internal Assessment | | | End Sem Exam | Exam Duration (Hrs) | | | |
| | | | 1 | 2 | Avg | | | | | |
| EC 301 | Signals & Systems | PCC | 40 | 40 | 40 | 60 | 2 | 25 | - | 125 |
| EC 302 | Computer Networks | PCC | 40 | 40 | 40 | 60 | 2 | 25 | 25 | 150 |
| EC 303 | Professional Communication and Ethics II | AEC | - | - | - | - | - | 50 | - | 50 |
| EC 304 | Software Engineering | MDM | 40 | 40 | 40 | 60 | 2 | | | 100 |
| EC 3xx | Department Level Optional Course I | PEC | 40 | 40 | 40 | 60 | 2 | 25 | 25 | 150 |
| IL 3xx | Institute Level Optional Course I | Open Elective (OE) | 40 | 40 | 40 | 60 | 2 | - | - | 100 |
| EC 391 | Programming Lab II(Web Programming) | Skill Courses | - | - | - | - | - | 25 | 25 | 50 |
| **Total** | | | | | | | | | | **725** |

1[#] to be taken class wise

**T- Theory , L- Lab , P-Programming, C- Communication**

Adm. Y2023-24

| Course Code | Department Level Optional Course (DLOC) I | Specializations |
|---|---|---|
| EC 305 | Artificial Intelligence | AIML |
| EC 306 | Advanced Database Management Systems + DWM | Data Analytics |
| EC 307 | Advanced Operating System | High Performance Computing |
| EC 308 | Embedded System Design & Basics of IOT | IOT |

| Course Code | Institute Level Optional Course (ILOC) I | Specializations |
|---|---|---|
| IL 360 | IPR and Patenting | **IP Management and Digital Business** |
| IL 361 | E- Commerce and E-Business | **Business Management** |
| IL 362 | Introduction to Bioengineering | **Bio Engineering** |
| IL 363 | Biomedical Instrumentation | **Bio Instrumentation** |
| IL 364 | Design of Experiments | **Engineering Design** |
| IL 365 | Design for Sustainability | **Sustainable Technologies** |
| IL 366 | Political Science | **Contemporary Studies** |
| IL 367 | Visual Arts | **Art and Journalism** |
| IL 368 | Modern Day Sensor Physics | **Applied Science** |
| IL 369 | Energy Audit and Management | **Green Technologies** |
| IL 370 | Maintenance of Electronics Equipment | **Maintenance Engineering** |
| IL 371 | Cooking and Nutrition | **Life Skills** |
| IL 372 | Environmental Management | **Environment** |
| IL 373 | Vehicle Safety | **Safety** |
| IL 388 | Quantum Computing and Technologies I | **Quantum Computing and Technologies** |

Adm. Y 2024

## Semester VI

| Course Code | Course Name | Category | Course Component | Teaching Scheme (Contact Hours) | | Credits Assigned | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | Pract/ Tuts | Theory | Pract/ Tuts | Total |
| EC 309 | Instrumentation & Control System | PCC | TLP | 3 | - | 3 | - | 3 |
| EC 310 | Computer Organization and Architecture | PCC | T | 3 | - | 3 | - | 3 |
| EC 311 | Software Testing and Quality Assurance | MDM | T | 3 | - | 3 | - | 3 |
| EC 3xx | Department Level Optional Course II | PEC | TL | 3 | 2 | 3 | 1 | 4 |
| EC 3xx | Department Level Optional Course III | PEC | TL | 3 | 2 | 3 | 1 | 4 |
| IL 3xx | Institute Level Optional Course II | Open Elective (OE) | T | 3 | - | 3 | - | 3 |
| EC 392 | Project A | Experiential Learning Courses | LPC | - | 4 | - | 2 | 2 |
| **Total** | | | | **18** | **8** | **18** | **4** | **22** |

| Course Code | Course Name | Category | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Theory | | | | | Term Work | Pract/ Oral | Total |
| | | | Internal Assessment | | | End Sem Exam | Exam Duration (Hrs) | | | |
| | | | 1 | 2 | Avg | | | | | |
| EC 309 | Instrumentation and Control System | PCC | 40 | 40 | 40 | 60 | 2 | - | - | 100 |
| EC 310 | Computer Organization and Architecture | PCC | 40 | 40 | 40 | 60 | 2 | - | - | 100 |
| EC 311 | Software Testing and Quality Assurance | MDM | 40 | 40 | 40 | 60 | 2 | - | - | 100 |
| EC 3xx | Department Level Optional Course II | PEC | 40 | 40 | 40 | 60 | 2 | 25 | 25 | 150 |
| EC 3xx | Department Level Optional Course III | PEC | 40 | 40 | 40 | 60 | 2 | 25 | 25 | 150 |
| IL 3xx | Institute Level Optional Course II | Open Elective (OE) | 40 | 40 | 40 | 60 | 2 | - | - | 100 |
| EC 392 | Project A | Experiential Learning Courses | - | - | - | - | - | 50 | 50 | 100 |
| **Total** | | | | | | | | | | **800** |

**T- Theory , L- Lab , P-Programming, C- Communication**

Adm. Yr 23-24

| Course Code | Department Level Optional Course (DLOC) II | Specializations |
|---|---|---|
| EC 312 | Foundations of Robotics | Robotics |
| EC 313 | Cryptography and System Security | System Security |
| EC 314 | Mobile & Distributed Computing | Cloud Computing |
| EC 315 | Integrated Circuit Technology | VLSI Design |

| Course Code | Department Level Optional Course (DLOC) III | Specializations |
|---|---|---|
| EC 316 | Machine Learning | AIML |
| EC 317 | Big Data Analytics | Data Analytics |
| EC 318 | Parallel Computing Architecture | High Performance Computing |
| EC 319 | Wireless Networks | IOT |

| Course Code | Institute Level Optional Course (ILOC) II | Specializations |
|---|---|---|
| IL 374 | Digital Business Management and Digital Marketing | **Entrepreneurship Development and Management** |
| IL 375 | Business Analytics | **Business Management** |
| IL 376 | Biomechanics | **Bioengineering** |
| IL 377 | Medical Image Processing | **Bio Instrumentation** |
| IL 378 | Product Design | **Engineering Design** |
| IL 379 | Technologies for Rural Development | **Sustainable Technologies** |
| IL 380 | Economics | **Contemporary Studies** |
| IL 381 | Journalism, Media and Communication studies | **Art and Journalism** |
| IL 382 | Operation Research for Management | **Applied Science** |
| IL 383 | Weather and Climate Informatics | **Green Technologies** |
| IL 384 | Maintenance of Mechanical Equipment | **Maintenance Engineering** |
| IL 385 | Physical Education | **Life Skills** |
| IL 386 | Industrial Regulations and Laws | **Environment** |
| IL 387 | Industrial and high voltage Safety | **Safety** |
| IL 389 | Quantum Computing and Quantum Technologies II | **Quantum Computing and Quantum Technologies** |

Adm. 2024

# Bachelor of Technology
# In
# Electronics & Computer Science

# (Semester V)

Adm. Y 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical /Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 301 | Signals and Systems | 03 | -- | 01 | 03 | -- | 01 | 04 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | 1 | 2 | Average | | | | | |
| EC 301 | Signals and Systems | 40 | 40 | 40 | 60 | 25 | -- | -- | 125 |

**Course Objectives:**

1. To identify, classify and analyze various types of signals and systems.
2. To analyze time Domain analysis of continuous and discrete time signals and systems.
3. To Analyze the continuous and discrete time LTI signals and systems in frequency domain using Fourier Transform.
4. To analyze, formulate and solve problems on frequency domain analysis of continuous time systems using Laplace Transform.
5. To analyze, formulate and solve problems on frequency domain analysis of discrete time systems using Z- Transform.
6. To provide foundation of signal and system concepts to areas like communication, control and comprehend applications of signal processing in communication systems.

**Course Outcomes:−After successful completion students will be able to**

1. Classify and analyze various types of signals and systems.
2. Apply the concept of convolution integral and convolution sum in signals and systems.
3. Analyze the continuous and discrete time signals and systems in frequency domain using Fourier Transform
4. Analyze, formulate and solve problems on frequency domain analysis of continuous time systems using Laplace Transform.
5. Analyze, formulate and solve problems on frequency domain analysis of continuous time systems using Z Transform.
6. Understand and apply the concept of FIR and IIR systems.

**Prerequisite:** Engineering Mathematics III

**DETAILED THEORY SYLLABUS:**

| Sr. No. | Module | Detailed Content | Hrs |
|---|---|---|---|
| 1. | **Introduction of Continuous and** | Introduction to Signals: Definition of Signals , Representation of continuous time signals and discrete time signals, Sampling theorem, sampling of continuous | 07 |

| | | | |
|---|---|---|---|
| | **Discrete Time Signals and systems:** | time signals Basic Elementary signals , Arithmetic operations on the signals- Time Shifting, Time scaling, Time Reversal of signals Classification of Continuous time signals and Discrete time signal<br>Introduction to Systems: Definition of Systems , Classification of Continuous time systems and Discrete time systems, Applications of Signals and Systems | |
| 2. | **Time domain analysis of continuous time and discrete time systems** | Linear Time Invariant (LTI) systems; impulse response, step response,<br>Convolution integral and Convolution sum for analysis of LTI systems, properties of convolution integral/sum, Correlation of Signals: Auto-correlation and Cross correlation of Continuous time signals (Numericals not expected) and Discrete time signals. | 06 |
| 3. | **Fourier Analysis of Continuous and Discrete Time Signals and Systems** | Fourier transform of periodic and non-periodic functions, Properties of Fourier Transform statements(Proofs not expected), Inverse Fourier Transform, Frequency Response: computation of Magnitude and Phase Response, Limitations of Fourier Transform | 07 |
| 4. | **Frequency domain analysis of continuous time system using Laplace transform** | Definition of Laplace Transform (LT), Region of Convergence (ROC), Properties of Laplace transform statements(Proofs not expected), Inverse Laplace transform.<br>Analysis of continuous time LTI systems using Laplace Transform: Causality and stability of systems in s-domain, Total Response of the system, Relation between LT and FT | 07 |
| 5. | **Frequency domain analysis of discrete time system using Z-transform** | Definition of unilateral and bilateral Z Transform, Region of Convergence (ROC),Properties of Z-Transform statements(Proofs not expected), Inverse Z-Transform. Analysis and characterization of the LTI system using Z transform: Transfer Function and difference equation, plotting Poles and Zeros of a transfer function, impulse and step response, causality, stability, Total response of a system. Relation between Laplace Transform and Z–Transform, Relation between ZT and FT | 08 |
| 6. | **FIR and IIR systems** | Concept of finite impulse response systems and infinite impulse response systems.<br>IIR Realization structures of LTI Discrete time system: Direct form –I and direct form II. | 04 |

| SR NO | List of Tutorials |
|---|---|
| 01 | Tutorial No 1 : Mathematical Operations on Continuous and Discrete time signals |
| 02 | Tutorial No 2 : Classifications of Continuous and Discrete time signals and systems |
| 03 | Tutorial No 3 : Convolution and Correlation of Continuous and Discrete time signals |
| 04 | Tutorial No 4 : Magnitude and Phase Response Sums of Fourier transform |
| 05 | Tutorial No 5 : ROC , properties of Laplace transform |

| | |
|---|---|
| 06 | Tutorial No 6 : Inverse Laplace transform and total response |
| 07 | Tutorial No 7 : ROC and properties of Z transform |
| 08 | Tutorial No 8 : Inverse Z transform , total response of ZT and FIR Realization structures |

**Theory Assessments:**

**1. Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.

**2. End Sem Theory Examination:**

- Question paper will consist of 4 questions, each carrying 20 marks.
- Total 3 questions need to be solved.
- Q.1 will be compulsory, based on the entire syllabus.
- Remaining questions will be randomly selected from all the modules.
- Weightage of marks should be proportional to the number of hours assigned to each module.

**Lab Assessments:**

**Term Work Assessment:**

- At least 08 tutorials covering the entire syllabus must be conducted.
- The tutorials should include easy, medium and high level thinking questions. Term work assessment must be based on the overall performance of the student with every tutorial graded from time to time. The grades should be converted into marks as per the Credit and Grading System manual and should be added and averaged. The grading and term work assessment should be done based on this scheme.

**Text Books:**

1. NagoorKani, “Signals and Systems”, Tata McGraw Hill, Third Edition, 2011.
2. Tarun Kumar Rawat, “Signals and Systems”, Oxford University Press 2016.

**References:**

1. Simon Haykin and Barry Van Veen, “Signals and Systems”, John Wiley and Sons, Second Edition, 2004.
**2**.Rodger E Ziemer, William H. Tranter and D. Ronald Fannin, “Signals and Systems”, Pearson Education, Fourth Edition 2009.
**3**.Alan V. Oppenheim, Alan S. Willsky and S. Hamid Nawab, “Signals and Systems”, Prentice-Hall of India, Second Edition, 2002.

Adm. 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical /Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 302 | Computer Networks | 03 | 02 | -- | 03 | 01 | -- | 04 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | 1 | 2 | Average | | | | | |
| EC 302 | Computer Networks | 40 | 40 | 40 | 60 | 25 | -- | 25 | 150 |

**Course Objectives:**

1. To introduce networking architecture and protocols.
2. To understand the various layers and protocols in the TCP/IP model.
3. To recognize different addressing schemes, connecting devices and routing protocols.
4. To select the required protocol from the application layer protocols.

**Course Outcomes: Upon successful completion students will be able to**

1. Demonstrate knowledge of networking concepts and necessary protocols.
2. Analyze the various layering structures of Physical Layer.
3. Evaluate various addressing schemes and connecting devices of Data Link Layer.
4. Analyze the various layering structures and routing protocols of Network Layer.
5. Understand the networking concepts and required protocols of Transport Layer.
6. Appreciate the various protocols in application layer.

**DETAILED THEORY SYLLABUS:**

| Sr. No. | Module | Detailed Content | Hrs |
|---|---|---|---|
| 1. | **Introduction to Network Architectures, Protocol Layers, and Service models** | Uses of computer networks. Topologies, LAN, MAN, WAN, Network topologies, Addressing : Physical / Logical /Port addressing, Protocols and Standards.<br><br>Protocol Architecture: Need of layered protocol architecture, Layers details of OSI, , Protocol Layers and Their Service Models TCP/IP Model: Protocol suite, Comparison of OSI and TCP/IP | 06 |

Adm. AY 23-24

| | | | |
|---|---|---|---|
| 2. | **Physical Layer** | Transmission Media: Guided media like Coaxial, fiber, twisted pair, and Wireless media, Transmission Impairments. Interconnecting Devices: Hub, Bridges, Switches, Router, Gateway<br><br>Data communication model : DTE, DCE, RS-232D Interface , Null Modem , Multiplexing : FDM , Synchronous TDM , Statistical TDM, ADSL , xDSL, Cable modem | 09 |
| 3. | **Data Link Control** | Data link services: Framing, Flow control, Error control, ARQ methods, Piggybacking<br><br>High Level Data Link Control (HDLC): HDLC configurations, Frame formats, Typical frame exchanges.<br><br>Medium Access Control Protocols: ALOHA, Slotted ALOHA, CSMA, CSMA/CD | 08 |
| 4. | **Network Layer** | Switching: Switched Communication networks, Circuit switching Networks, , Circuit switching Concepts, Packet switching Principles: Virtual circuit switching and Datagram switching<br><br>Routing in Packet Switching Networks: Characteristics, Routing strategies, Link state Routing versus Distance vector Routing. Least-Cost Routing Algorithms: Dijkstra's Algorithm, Bellman Ford Algorithm.<br><br>Internet Protocol: Principles of Internetworking: Requirements, Connectionless Operation Internet Protocol Operation: IP packet, IP addressing, subnet addressing , IPv4, ICMP, ARP, RARP IPv6 ( IPv6 Datagram format, comparison with IPv4, and transition from IPv4 to IPv6) | 04 |
| 5. | **Transport Layer** | Connection –oriented Transport Protocol Mechanisms: Transmission Control Protocol (TCP): TCP Services, TCP Header format, TCP three way handshake, TCP state transition diagram. User datagram Protocol (UDP)<br><br>Congestion: Effects of congestion, Congestion control methods, Traffic management, Congestion control in Packet switching Networks | 08 |
| 6. | **Application Layer** | Application layer Protocols : HTTP, FTP, DNS,SMTP, SSH | 04 |

Adm. Y 2024

**DETAILED LAB SYLLABUS:**

**Hardware Requirements:** Switches Routers, Cables Crimping Tools

**Software Requirements:** Cisco PacketTRacer, NS 2

| Sr. No. | Detailed Lab Description |
|---|---|
| 1 | To study basic networking commands. |
| 2 | To perform crimping and set up a LAN connection. |
| 3 | To configure a network using Distance Vector Routing Protocol-RIP using Cisco Packet Tracer. |
| 4 | Configure a network using Path Vector Routing Protocol- BGP using Cisco Packet Tracer |
| 5 | To perform subnetting using Cisco Packet Tracer. |
| 6 | To study about NS2 simulator in detail. |
| 7 | Creating two nodes and set up a LAN connection using NSG 2.1 |
| 8 | To Simulate and to study stop and Wait protocol using NS 2.1 |
| 9 | To Simulate Sliding Window protocol using NS 2.1 |

**Theory Assessments:**

**1. Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.

**2. End Sem Theory Examination:**

- Question paper will consist of 4 questions, each carrying 20 marks.
- Total 3 questions need to be solved.
- Q.1 will be compulsory, based on the entire syllabus.
- Remaining questions will be randomly selected from all the modules.
- Weightage of marks should be proportional to number of hours assigned to each module.

**Lab Assessments:**

**1. Term Work Assessment:**

- At least 08 experiments covering entire syllabus and one mini project should be set to have well predefined inference and conclusion.
- The experiments should be students' centric and attempt should be made to make experiments more meaningful, interesting and innovative. Term work assessment must be based on the overall performance of the student with every experiment graded from time to time. The grades should be converted into marks as per the Credit and Grading System manual and should be added and averaged. The grading and term work assessment should be done based on this scheme.

Adm. Y 23-24

**2. Oral/Viva Assessment:**

The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. Practical and Oral exam will be based on the entire syllabus. Students are encouraged to share their experiments/mini project codes on online repository.

**Text Books:**


1. Data Communications and Networking – Behrouz A. Forouzan, Fourth Edition TMH,2006.
2. Computer Networks -Andrew S Tanenbaum, 4th Edition, Pearson Education..
3. Alberto Leon Garcia, “Communication Networks” , McGraw Hill Education, Second Edition.
4. J. F. Kurose and K. W. Ross ,”Computer Networking: A Top-Down Approach”, Addison Wesley, 5th Edition


**References:**


1. An Engineering Approach to Computer Networks-S.Keshav,2nd Edition, Pearson Education.
2. Understanding communications and Networks,3rd Edition, W. A. Shay, Cengage Learning T L Singal “wireless communications”, Mc Graw Hill Education
3. Computer and Communication Networks, Nader F. Mir, Pearson Education.
4. Computer Networking: A Top-Down Approach Featuring the Internet, James F.Kurose,K.W.Ross,3rd Edition, Pearson Education.


Adm. Y23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical /Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 303 | Professional Communication & Ethics II | 01 | -- | 02 | 01 | -- | 01 | 02 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | 1 | 2 | Average | | | | | |
| EC 303 | Professional Communication & Ethics II | -- | -- | -- | -- | 50 | -- | -- | 50 |

**Course Objectives:**By the end of the course, learners will be able to:

1. Develop awareness of academic discourse genres, their communicative purpose, rhetorical structure, and disciplinary conventions.
2. Enhance academic writing skills through practice in research paper writing, literature reviews, proposals, and abstracts.
3. Build precision, objectivity, and abstraction in language use through academic and technical features like nominalisation, modality, and lexical cohesion.
4. Train students in effective multimodal and oral communication through data presentation, proposal presentations, and academic discourse strategies.
5. Cultivate professional and interpersonal communication skills, including resume writing, interviews, and group discussions.
6. Promote ethical and responsible communication practices, including citation conventions, digital discourse, and professional etiquette.

**Course Outcomes:**Upon successful completion of this course, students will be able to:

1. **CO1**: Identify, analyze and write research papers on the basis of the structure, purpose, and rhetorical features of academic and professional genres.
2. **CO2**: Define problem, solution of proposals, and literature reviews using genre-specific conventions.
3. **CO3**: Demonstrate professional communication skills through resume writing, group discussions, and interviews.
4. **CO4:** Present data effectively using visual-verbal coordination, discourse markers, and spoken register features.
5. **CO5:** Apply ethical use of language in digital communication and virtual collaboration.
6. **CO6**: Exhibit etiquette in email writing, academic and professional communication settings.

Acad-Y 23-24

| Sr. No. | Module | Detailed Content | Hrs |
|---|---|---|---|
| 1. | **Research Paper Writing - Structure, Style and Language** | **Academic Discourse Genres**: Purpose, aim, and format of research papers; **acquisition of academic genre awareness**<br>**Literature Review as Intertextual Practice**: Summarising sources, citation as stance and voice, avoiding plagiarism using quotation and paraphrasing effectively; **developing intertextual synthesis and citation skills**<br>**Research Methodology**: **Disciplinary Discourse** (the specific language and conventions used within a particular academic field), and **Nominalisation** (the transformation of verbs or adjectives into nouns to create a more formal, abstract style of writing, e.g., "analyse" → "analysis"); **acquiring precision and abstraction in writing**<br>**Presenting Data**: Visual-verbal integration, cohesive devices in figure descriptions; **developing multimodal expression and linguistic labelling skills**<br>**Writing the Discussion**: Move structure analysis, use of modality and evaluative language; **acquiring evaluative and critical commentary skills**<br>**Referencing Conventions**: IEEE citation style, citation as grammatical metaphor; **mastery of referencing conventions and stylistic precision**<br>**Writing an Abstract**: Genre analysis and rhetorical moves (Swales' IMRAD model); **summarisation and structural awareness of academic abstracts**<br>**Coherence and Cohesion**: Anaphora, cataphora, lexical cohesion; theme–rheme structure, discourse markers and lexical bundles; **acquiring cohesion strategies and discourse flow management** | 3 |
| 2. | **Writing Technical Proposals** | **Proposal as Genre**: Move structure (problem-solution pattern), audience awareness, **understanding persuasive academic genres**<br>**Executive Summary**: Information packaging, genre-specific register; **acquisition of concise summarisation techniques**<br>**Defining the Problem and Solution**: Argumentation structure, lexical density, **developing logical structuring and technical vocabulary**<br>**Technical Language Use**: Hedging, modality, nominal style; **acquiring formality, objectivity, and linguistic caution in writing**<br>**Writing with Purpose**: Field, tenor, and mode (Systemic Functional Linguistics); **enhancing genre and register control**<br>**Presentation on Proposal**: Spoken register features and visual-verbal coordination; **developing professional oral communication strategies** | 3 |

AY 23-24

| | | | |
|---|---|---|---|
| 3. | **Employability Skills** | **Group Discussion**: Turn-taking, topic management, repair strategies, politeness theory; **developing interactive and collaborative discourse skills**<br>**Case-based Discussions**: Conflict resolution using discourse strategies, team and cross-cultural communication (intercultural pragmatics), language use; **developing problem-solving and culturally sensitive communication skills**<br>**Cover Letter, Resume and Statement of Purpose**: Genre conventions, stance and engagement; **developing personal narrative and professional identity construction**<br>**Interview Skills**: Speech Acts (Self-introduction, requests, justifications), pragmatics of self-presentation; **mastering pragmatic competence and strategic self-representation**<br>**The interpersonal skills required for GD and Interview should be dealt with in the form of role play in the tutorial class** | 3 |
| 4. | **Presentation Skills** | **Presentation Skills**: Spoken academic discourse, paralinguistic features, discourse intonation; **acquiring fluency and control in formal presentations**<br>**All the strategies and skills required for preparing slides, delivering content should be adhered to while teaching presentation skills.** | **2** |
| 5. | **Ethics and Ethical Codes of Conduct** | **Engineering Ethics**: Critical discourse analysis of professional language; **acquiring critical evaluation of ethical language use**<br>**Professional Responsibilities**: Register variation and power relations; **understanding discourse and institutional power**<br>**Ethical Codes (IEEE, ASME)**: Institutional discourse analysis; **acquisition of technical and regulatory genre conventions**<br>**Digital and Cyber Ethics**: Multimodal discourse and netiquette; **mastering digital communication norms and ethical language use**<br>**Virtual Collaboration**: Language of professionalism in asynchronous communication; **acquiring discourse strategies for virtual team environments** | **1** |
| 6. | **Etiquettes** | **Classroom and Workplace Etiquette with special reference to email etiquette** | **1** |

**Detail Tutorial Sessions**

| Sr. No. | Tutorials | Details of Activities | Hours |
|---|---|---|---|
| I | Tutorial 1 | **Role Play on Interpersonal Skills**: Leadership Skills, Collaboration, Teamwork, Conflict Resolution, Negotiation, and Time Management | 2 hrs |
| II | Tutorial 2 | **Student Grant Proposal Form and Group Discussion**: Case-study Approach | 2 hrs |
| III | Tutorial 3 | **Group Discussion continued** | 2 hrs |
| IV | Tutorial 4 | Cover letter, Resume and SOP | 2 hrs |
| V | Tutorial 5 | Performing Mock-interview | 2 hrs |
| VI | Tutorial 6 | Mock Interview continued | 2 hrs |

Ac-Yr 23-24

| | | | |
|---|---|---|---|
| VII | Tutorial 7 | Final Interview | 2 hours |
| VIII | Tutorial 8 | Final Interview | 2 hours |
| IX | Tutorial 6 | Performing Mock-Group Discussion | 2 hours |
| X | Tutorial 7 | Final Group Discussion | 2 hours |
| XI | Tutorial 8 | **Research Methodology**: Survey Method and Questionnaire | 2 hours |
| XII | Tutorial 9 | Final presentation on Research Paper | 2 hours |
| XIII | Tutorial 10 | Final Presentation on Proposal | 2 hours |

**Term work Assessment:**

Term work will consist of-
Research paper - 05 marks,
Research paper presentation-10 marks
Group Discussion-10 marks
Interviews-5 marks
Technical Proposal- 5 marks
Proposal Presentation- 10 marks
Attendance -5 marks

The final certification and acceptance of term work ensures that satisfactory performance in class activities and assignments is met by the student.

**Text Books:**


1. Raman Meenakshi & Sharma Sangeeta, Technical Communication Principles and Practice,Second edition, Oxford University Press.

2. Dr, S. S. Bhakar & Dr. Tarika Singh. A handbook for Writing Research Paper. First edition, Bharati Publications, New Delhi.
3. Virendra Singh Nirban, Krishna Mohan, RC Sharma, *Business Correspondence and Report Writing*


Adm. Y 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical/ Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 304 | Software Engineering | 03 | -- | -- | 03 | -- | -- | 03 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | 1 | 2 | Average | | | | | |
| EC 304 | Software Engineering | 40 | 40 | 40 | 60 | - | -- | - | 100 |

**Course Objectives:**

1. To demonstrate and evaluate real time projects with respect to software engineering principles.
2. To provide the knowledge of software engineering discipline.
3. To apply analysis, design and testing principles to software project development.
4. To design and develop different software projects.
5. To provide knowledge about gathering requirements, analysing them and to develop prototypes.

**Course Outcomes: Upon successful completion of the course students will be able to**

1. Understand and demonstrate basic knowledge in software engineering.
2. Identify requirements, analyze and prepare models.
3. Plan, schedule and track the progress of the projects.
4. Design & develop the software projects.
5. Identify risks, manage the change to assure quality in software projects.
6. Apply testing principles on software project and understand the maintenance concepts.

**Prerequisite:**

1. Concepts of Object Oriented Programming & Methodology
2. Knowledge of developing applications with front end & back end connectivity.

**DETAILED THEORY SYLLABUS:**

| Sr. No. | Module | Detailed Content | Hrs |
|---|---|---|---|
| 1. | **Introduction to software Engineering process paradigms and Agile methodology** | Generic view of Process, Software Process, Capability Maturity Model (CMM)", Prescriptive Models: Waterfall Model, Incremental-RAD Model, Evolutionary Process Model Prototyping, Spiral and Concurrent Development Model, Specialized Models: Component based, Aspect Oriented Development, Agile Methodology, Agility | 06 |

Acad. Y 23-24

| | | | |
|---|---|---|---|
| | | Principles, Scrum and Extreme Programming & Kanban model | |
| 2. | **Requirement Elicitation and Software Project estimation.** | Requirement, Types of Requirements, Requirement gathering, Requirement Engineering Task, Identifying Stakeholders, Multiple viewpoints, SRS (Software Requirement Specification), Project Estimation, LOC based, FP based and Use case based estimation, Management Spectrum, 4Ps (people, product and process), Process & Project metrics. | 08 |
| 3. | **Project Scheduling , Monitoring & Risk Management** | Project scheduling: Defining a Task Set for the Software Project, Timeline charts, Tracking the Schedule, Earned Value Analysis, Risk Identification, Risk Assessment, Risk Projection, RMMM | 06 |
| 4. | **Software Analysis and design** | Introduction of Analysis elements, Scenario based, Flow based, behavior and class based Design Concepts, Classification of UML, Developing UML Diagrams , Requirement Model – Scenario-based model, Class-based model, Behavioral model. Principles, Architecture Design, Coupling vs. Cohesion, Post Development models-Component Level Design, System Level Design, Types of User Interface Design & develop an UI Design | 07 |
| 5. | **Software Configuration management and quality Assurance** | SCM Process, Version control management, Re- engineering & Reverse Engineering, SCM repositories, Software Quality Assurance Task and Plan, Software Reliability, Formal Technical Review (FTR), Walkthrough, McCall's Quality Factor | 05 |
| 6. | **Software testing and Web Engineering** | Purpose of STLC, Strategic Approach of Testing , White-Box, Grey- Box and Black Box testing and their types, Boundary-value Analysis, Path Testing- Calculate Cyclomatic Complexity, Equivalence class partitioning, Types of Software Testing – Manual Testing, Automated Testing, Object-oriented Testing approach, Derive a Test case, Importance of Web Engineering, Web project planning and management, Web-based System ,Major Differences between Web Applications and Conventional Software, Elements of Web Site Construction | 07 |

Adm. Yr. 23-24

**Theory Assessments:**

**1. Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.

**2. End Sem Theory Examination:**

- Question paper will consist of 4 questions, each carrying 20 marks.
- Total 3 questions need to be solved.
- Q.1 will be compulsory, based on the entire syllabus.
- Remaining questions will be randomly selected from all the modules.

- Weightage of marks should be proportional to number of hours assigned to each module.

**Text Books:**


1. Roger Pressman, ―Software Engineering: A Practitioner‘s Approach", McGraw-Hill Publications (7th edition)
2. Ian Sommerville, ―Software Engineering‖, Pearson Education (9th edition)
3. Ali Behfrooz and Fredeick J. Hudson, "Software Engineering Fundamentals", Oxford University Press


**References:**


1. Pankaj Jalote, "An integrated approach to Software Engineering", Springer/Narosa
2. Rajib Mall, "Fundamentals of Software Engineering", Prentice Hall India
3. Ugrasen Suman, ―Software Engineering – Concepts and Practices‖, Cengage Learning
4. Jibitesh Mishra and Ashok Mohanty, ―Software Engineering‖, Pearson


Adm. Y 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical /Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 305 | Artificial Intelligence | 03 | 02 | -- | 03 | 01 | -- | 04 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | 1 | 2 | Average | | | | | |
| EC 305 | Artificial Intelligence | 40 | 40 | 40 | 60 | 25 | -- | 25 | 150 |

**Course Objectives:**

1. To gain perspective of AI and its foundations.
2. To study different agent architectures and properties of the environment.
3. To understand the basic principles of AI towards problem solving, inference, perception, knowledge representation, and learning.
4. To investigate probabilistic reasoning under uncertain and incomplete information.
5. To explore the current scope, potential, limitations, and implications of intelligent systems.

**Course Outcomes: Upon successful completion of the course students will be able to:**

1. Understand the fundamental concepts of AI.
2. Identify the characteristics of the environment and differentiate between various agent architectures.
3. Apply the most suitable search strategy to design problem solving agents.
4. Represent a natural language description of statements in logic and apply the inference rules to design Knowledge Based agents.
5. Comprehend planning problem and various learning techniques.
6. Analyze current trends and challenges in AI and Understand the fundamentals of natural language processing and robotics.

**Prerequisite: Discrete Mathematics, Data Structures**

Adm. Y23-24

**DETAILED THEORY SYLLABUS:**

| Sr. No. | Module | Detailed Content | Hours |
|---|---|---|---|
| 1. | **Introduction to Artificial Intelligence** | 1.1: Introduction, History of Artificial Intelligence, Intelligent Systems: Categorization of Intelligent System, Components of AI Program, Foundations of AI, Sub-areas of AI, Applications of AI, Current trends in AI. | 4 |
| 2. | **Intelligent Agents** | 2.1: Agents and Environments, The concept of rationality, The nature of environment, The structure of Agents, Types of Agents, Learning Agent.<br>2.2: Solving problem by Searching: Problem Solving Agent, Formulating Problems, Example Problems. | 4 |
| 3. | **Problem solving** | 3.1: Uninformed Search Methods: Breadth First Search (BFS), Depth First Search (DFS), Depth Limited Search, Depth First Iterative Deepening (DFID), Informed Search Methods: Greedy best first Search, A* Search, Memory bounded heuristic Search.<br>3.2: Local Search Algorithms and Optimization Problems: Hill climbing search Simulated annealing, Genetic algorithms.<br>3.3: Adversarial Search: Game Playing, Min-Max Search, Alpha Beta Pruning | 10 |
| 4. | **Knowledge and Reasoning** | 4.1: Knowledge based Agents, Brief Overview of propositional logic, First Order Logic: Syntax and Semantic, Inference in FOL, Forward chaining, backward Chaining.<br>4.2: Knowledge Engineering in First-Order Logic, Unification, Resolution<br>4.3: Uncertain Knowledge and Reasoning: Uncertainty, Representing knowledge in an uncertain domain, The semantics of belief network, Simple Inference in belief network | 9 |
| 5. | **Planning and Learning** | 5.1: The planning problem, Planning with state space search, Partial order planning, Hierarchical planning, Conditional Planning.<br>5.2: Learning: Forms of Learning, Theory of Learning, PAC learning. Introduction to statistical learning (Introduction only) Introduction to reinforcement learning: Learning from Rewards, Passive Reinforcement Learning, Active reinforcement Learning | 6 |
| 6. | **Emerging Topics in AI** | 6.1 Introduction to Generative AI, Transformer Models and LLMs (GPT, BERT), Agentic AI and Autonomous Systems, Ethical and Social Implications of AI, Explainable AI (XAI)(only brief introduction)<br>6.2 Introduction to NLP- Language models, Grammars, Parsing, Introduction to Robotics and Perception, Planning and Motion in Robotics | 6 |

Adm 2023-24

**DETAILED LAB SYLLABUS:**

**Lab Prerequisite: Discrete Mathematics, Data Structure**
**Suggested List of Experiments:**

| Sr. No. | Title of the experiment |
|---|---|
| **1** | Provide the PEAS description and TASK Environment for a given AI problem. |
| **2** | Identify suitable Agent Architecture for the problem |
| **3** | Write simple programs using PROLOG as an AI programming Language |
| **4** | Implement any one of the Uninformed search techniques |
| **5** | Implement any one of the Informed search techniques e.g. A-Star algorithm for 8 puzzle problem |
| **6** | Implement adversarial search using min-max algorithm. |
| **7** | Implement any one of the Local Search techniques. e.g. Hill Climbing, Simulated Annealing, Genetic algorithm |
| **8** | Prove the goal sentence from the following set of statements in FOPL by applying forward, backward and resolution inference algorithms. |
| **9** | Create a Bayesian Network for the given Problem Statement and draw inferences from it. (You can use any Belief and Decision Networks Tool for modeling Bayesian Networks) |
| **10** | Implement a Planning Agent |
| **11** | Design a prototype of an expert system |
| **12** | Case study of any existing successful AI system |

Adm. AY 23-24

**Theory Assessments:**

1. **Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.
2. **End Sem Theory Examination:**
   - Question paper will consist of 4 questions, each carrying 20 marks.
   - Total 3 questions need to be solved.
   - Q.1 will be compulsory, based on the entire syllabus.
   - Remaining questions will be randomly selected from all the modules.
   - Weightage of marks should be proportional to number of hours assigned to each module.

**Lab Assessment:**

1. **Termwork Assessment:** Term Work shall consist of at least 8 to 10 experiments based on the above list. Also Term work Journal must include at least 2 assignments. Term Work Marks: 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance). The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.
2. **Oral/Viva Assessment:** An oral exam will be held based on the above syllabus.

**Text Books:**


1. Stuart J. Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", Fourth Edition" Pearson Education, 2020.
2. Saroj Kaushik, "Artificial Intelligence", Cengage Learning, First edition, 2011
3. George F Luger, "Artificial Intelligence" Low Price Edition, Fourth edition, Pearson Education.,2005


**References:**


1. Nils J. Nilsson, Principles of Artificial Intelligence, Narosa Publication.
2. Deepak Khemani, A First Course in Artificial Intelligence, McGraw Hill Publication
3. Patrick H. Winston, Artificial Intelligence, 3rd edition, Pearson Education.
4. Elaine Rich and Kevin Knight, "Artificial Intelligence", Third Edition, McGraw Hill Education,2017.
5. Ivan Bratko, ―PROLOG Programming for Artificial Intelligence‖, Pearson Education, Third Edition.
6. D. W. Patterson, Artificial Intelligence and Expert Systems, Prentice Hall.


**Useful Links :**

1. https://nptel.ac.in/courses/106105078
2. https://nptel.ac.in/courses/106105079

Adm. AY-23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical /Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 306 | Advance Database Management System + Data Warehousing & Mining | 03 | 02 | -- | 03 | 01 | -- | 04 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | 1 | 2 | Average | | | | | |
| EC 306 | Advance Database Management System + Data Warehousing & Mining | 40 | 40 | 40 | 60 | 25 | -- | 25 | 150 |

**Course Objectives:**

1. To provide insights into distributed database designing.
2. To specify the various approaches used for using XML and JSON technologies.
3. To apply the concepts behind the various types of NoSQL databases and utilize it for Mongodb.
4. To identify the significance of Data Warehousing and Mining.
5. To develop research interest towards advances in data mining.

**Course Outcomes: Upon successful completion students will be able to**

1. Design distributed databases using the various techniques for query processing.
2. Organize the data using XML and JSON database for better interoperability.
3. Compare different types of NoSQL databases.
4. Formulate NoSQL queries using Mongodb.
5. Understand data warehouse fundamentals and design data warehouse with dimensional modelling and apply OLAP operations.
6. Understand data mining principles and perform Data preprocessing and Visualization.

**Prerequisite:** Database Management System (DBMS)

**DETAILED THEORY SYLLABUS:**

| Sr. No. | Module | Detailed Content | Hrs |
|---|---|---|---|
| 1. | **Distributed Databases** | Introduction, Distributed DBMS Architecture, Data Fragmentation, Replication and Allocation Techniques for Distributed Database Design, Distributed Transaction Management – Definition, properties, types, architecture. Distributed Query Processing - Characterization of Query Processors, Layers/ phases of query processing. Distributed Concurrency Control- Taxonomy, Locking based, Basic TO | 08 |

A.Y. 23-24

| | | | |
|---|---|---|---|
| | | algorithm, Recovery in Distributed Databases: Failures in distributed database, 2PC and 3PC protocol. | |
| 2. | **Data interoperability – XML and JSON** | XML Databases: Document Type Definition, XML Schema, Querying and Transformation: XPath and XQuery. Basic JSON syntax, (Java Script Object Notation),JSON data types, Stringifying and parsing the JSON for sending & receiving, JSON Object retrieval using key-value pair and JQuery, XML Vs JSON. | 05 |
| 3. | **NoSQL Distribution Model** | NoSQL database concepts: NoSQL data modeling, Benefits of NoSQL, comparison between SQL and NoSQL database system. Replication and sharding, Distribution Models Consistency in distributed data, CAP theorem, Notion of ACID Vs BASE, handling Transactions, consistency and eventual consistency. Types of NoSQL databases: Key-value data store, Document database and Column Family Data store, Comparison of NoSQL databases w.r.t CAP theorem and ACID properties. | 07 |
| 4. | **NoSQL using MongoDB** | NoSQL using MongoDB: Introduction to MongoDB Shell, Running the MongoDB shell, MongoDB client, Basic operations with MongoDB shell, Basic Data Types, Arrays, Embedded Documents. Querying MongoDB using find() functions, advanced queries using logical operators and sorting, simple aggregate functions, saving and updating documents. MongoDB Distributed environment: Concepts of replication and horizontal scaling through sharding in MongoDB. | 05 |
| 5. | **Data Warehousing Fundamentals** | Introduction to Data Warehouse, Data warehouse architecture, Data warehouse versus Data Marts, E-R Modeling versus Dimensional Modeling, Information Package Diagram, Data Warehouse Schemas; Star Schema, Snowflake Schema, Factless Fact Table, Fact Constellation Schema. Update to the dimension tables. Major steps in ETL process, OLTP versus OLAP, OLAP operations: Slice, Dice, Rollup, Drilldown and Pivot. | 07 |
| 6. | **Introduction to Data Mining, Data Exploration and Data Pre-processing** | Data Mining Task Primitives, Architecture, KDD process, Issues in Data Mining, Applications of Data Mining, Data Exploration: Types of Attributes, Statistical Description of Data, Data Visualization, Data Preprocessing: Descriptive data summarization, Cleaning, Integration & transformation, Data reduction, Data Discretization and Concept hierarchy generation. | 07 |

**DETAILED LAB SYLLABUS:**

**Software Requirements:** SQL, Java/Python, WEKA

| Sr. No. | Detailed Lab Description |
|---|---|
| 1 | Design of a distributed database for a real life application - Fragmentation, Query Processing. |
| 2 | Simulation of Recovery methods in distributed DB. |
| 3 | Design XML schema for real life application and write queries using XPath & XQuery. |
| 4 | Implement data transfer using JSON. |
| 5 | Design a database using NoSQL model and query it. |

| | |
|---|---|
| 6 | Implement different operations in MongoDB. |
| **7** | One case study on building Data warehouse/Data Mart -Write Detailed Problem statement and design dimensional modelling (creation of star and snowflake schema). |
| 8 | Implementation of all dimension table and fact table based on the case study. |
| 9 | Implementation of OLAP operations: Slice, Dice, Rollup, Drilldown and Pivot based on the case study. |
| 10 | Perform data Pre-processing task and demonstrate Classification, Clustering, Association algorithm on data sets using data mining tool (WEKA/R tool). |

**Theory Assessments:**

**1. Internal Assessment**: Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.

**2. End Sem Theory Examination:**

- Question paper will consist of 4 questions, each carrying 20 marks.
- Total 3 questions need to be solved.
- Q.1 will be compulsory, based on the entire syllabus.
- Remaining questions will be randomly selected from all the modules.
- Weightage of marks should be proportional to number of hours assigned to each module.

**Lab Assessments:**

**1.Term work Assessment:**

Term work should consist of minimum 8-10 experiments. Journal must include at least 2 assignments on content of theory and practical. The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. Total 25 Marks (Experiments: 15-marks, Attendance (Theory & Practical): 05-marks, Assignments: 05-marks).

**2. Oral/Viva Assessment**: Oral exam to be conducted by Internal & External examiners.

**Text Books:**


1. Korth, Siberchatz,Sudarshan, “Database System Concepts”, 6thEdition, McGraw Hill.
2. Elmasri and Navathe, “Fundamentals of Database Systems”, 5thEdition, Pearson Education.
3. Ozsu, M. Tamer, Valduriez, Patrick, “Principles of distributed database systems”,3rd Edition, Pearson Education, Inc.
4. PramodSadalge, Martin Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Addison Wesely/ Pearson.
5. Jeff Friesen , Java XML and JSON,Second Edition, 2019, après Inc.
6. Paulraj Ponniah, “ Data Warehousing: Fundamentals for IT Professionals”, Wiley India.
7. Han, Kamber, “Data Mining Concepts and Techniques”, Morgan Kaufmann 2nd edition.


Adm. Y 23-24

**References:**


1. Peter Rob and Carlos Coronel,Database Systems Design, Implementation and Management, Thomson Learning, 5thEdition.
2. Adam Fowler, NoSQL for dummies, John Wiley & Sons, Inc.
3. Shashank Tiwari, Professional NOSQL, John Willy & Sons. Inc
4. MongoDB Manual : https://docs.mongodb.com/manual.
5. Reema Theraja, "Data warehousing", Oxford University Press 2009.
6. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, "Introduction to Data Mining", Pearson Publisher 2nd edition.
7. Ian H. Witten, Eibe Frank and Mark A. Hall, "Data Mining", Morgan Kaufmann 3rd edition.


Adm. Y 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical/ Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 307 | Advanced Operating System | 03 | 02 | -- | 03 | 01 | -- | 04 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | 1 | 2 | Average | | | | | |
| EC 307 | Advanced Operating System | 40 | 40 | 40 | 60 | 25 | -- | 25 | 150 |

**Course Objectives:**

1. To learn the architectural differences and issues related to the Advanced Operating System.
2. To learn the Unix Operating System.
3. To get a comprehensive knowledge of the distributed systems.
4. To get a comprehensive knowledge of Real time operating system.
5. To get a thorough knowledge of database operating systems.
6. To get thorough knowledge of Mobile Os and cloud operating System.

**Course Outcomes: Upon successful completion of the course students will be able to**

1. Apply the principles and concepts in analyzing and designing Advance Operating System.
2. Learn the Unix Operating System.
3. Demonstrate the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system
4. Understand a comprehensive knowledge of Real time operating system.
5. Learn knowledge of database operating systems
6. Analyze the performance and reliability of different Advanced Operating Systems.

**Prerequisite:** Knowledge of Operating System

**DETAILED THEORY SYLLABUS:**

| Sr. No. | Module | Detailed Content | Hrs |
|---|---|---|---|
| 1. | **Introduction to Advanced operating System** | Functions of operating systems, Design approaches: layered, kernel based and virtual machine approach, types of advanced operating systems (NOS, DOS, Multiprocessor OS, Mobile OS,RTOS, Cloud OS) | 07 |
| 2. | **Unix Kernel and File Management** | System Structure, User Perspective, Architecture of Unix Operating System, Buffer cache: Header, Buffer Pool, | 07 |

AUGUST 23-24

| | | | |
|---|---|---|---|
| | | Retrieving, Reading and Writing Buffer, File Representation: inodes: Structure of file Directories, Path conversion to inode, superblock, inode assignment, allocation of disk blocks | |
| 3. | **Distributed Operating system concepts** | Goals, Distributed Computing Models, Hardware Concepts, Software Concepts, Architecture of DOS. Design Issues: Transparency, Flexibility, Scalability, Reliability, Performance, fault tolerance, Distributed Mutual Exclusion: Introduction, Classification of Mutual Exclusion algorithms, Mutual Exclusion Algorithms, Distributed Deadlock: Introduction, deadlock handling strategies, Deadlock detection: Issues and resolution | 07 |
| 4. | **Real Time Operating Systems and Mobile OS** | Characteristics of Real Time operating Systems, Classification of Real Time Operating Systems, Scheduling in RTOS: Clock driven: cyclic, Event driven: EDF and rate monotonic scheduling, Resource Handling: Resource Sharing, Priority Inversion, PIP, PCP, HLP. Scheduling real time tasks in distributed systems | 08 |
| 5. | **Database Operating systems** | Concurrency control : Database systems, Concurrency control model of database systems, Problem of Concurrency Control, serializability theory, Distributed Database Systems.<br>Concurrency Control Algorithms : asic synchronization Algorithms, Lock based, Timestamp based and Optimistic Algorithms, Concurrency Control Algorithms : Data Replication | 06 |
| 6. | **Mobile OS** | Architecture, Android OS, iOS, Virtual OS, Cloud OS and their design issues | 04 |

**DETAILED LAB SYLLABUS:**

**Software Requirements:** Windows/linux

| Sr. No. | Detailed Lab Description |
|---|---|
| 1 | Design and developed shell script that support Following Command ls, date, time, echo, cat, pwd, cp, |
| 2 | Write a multi-class multithreaded program that simulates multiple sleeping barbers, all in one barbershop that has a finite number of chairs in the waiting room. Each customer is instantiated from a single customer class; each barber is instantiated from a single Barber class |
| 3 | Implement the program for EDF |
| 4 | Implement the Program for Rate Monotonic algorithm |
| 5 | Implement a distributed share list among a group of mobile device users which is similar to Google document. |
| 6 | IOs, Android OS, Cloud OS |

Adm. Y23-24

**Theory Assessments:**

**1. Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.

**2. End Sem Theory Examination:**

- Question paper will consist of 4 questions, each carrying 20 marks.
- Total 3 questions need to be solved.
- Q.1 will be compulsory, based on the entire syllabus.
- Remaining questions will be randomly selected from all the modules.

Weightage of marks should be proportional to number of hours assigned to each module.

**Lab Assessments:**

- Term work should consist of 10 experiments.
- Journal must include at least 2 assignments.
  1. **Term work Assessment:** Total 25 Marks (Experiments: 10-marks, Attendance Theory & Practical: 05-marks, Assignments: 10-marks)
  2. **Oral/Viva Assessment**:
     Based on the above contents and entire syllabus.

**Text Books:**


1. Mukesh Singhal and Niranjan G.Shivaratri, "Advanced concepts in operating systems: Distributed, Database and multiprocessor operating systems" . MC Graw Hill education.
2. Rajib Mall, “Real-Time Systems: Theory and Practice”, Pearson education.


**References:**


1. Andrew S.Tanenbaum, "Modern Systems Principles and Paradigms". PHI.
2. Pradeep K.Sinha, "Distributed Operating System-Concepts and design", PHI.
3. Andrew S.Tanenbaum, "Distributed Operating System", Pearson Education.
4. Jane W. S. Liu, “Real Time Systems”, Pearson education.


Adm. Y 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical /Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 308 | Embedded System Design and basics of IOT | 03 | 02 | --- | 03 | 01 | --- | 04 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | 1 | 2 | Avg. | | | | | |
| EC 308 | Embedded System Design and basics of IOT | 40 | 40 | 40 | 60 | 25 | -- | 25 | 150 |

**Course Objectives:**

1. To introduce the foundational concepts, architecture, and real-world applications of embedded systems.
2. To develop understanding of embedded hardware components, interfacing techniques, and power considerations in system design.
3. To impart knowledge of embedded software development, RTOS concepts, device drivers, and system programming techniques.
4. To provide insight into hardware-software integration, real-time system constraints, and industry-based case studies.
5. To explore the fundamentals of IoT, including architectures, communication models, and application-layer protocols.
6. To enable the design and development of end-to-end IoT systems including integration, cloud connectivity, analytics, and security.

**Course Outcomes:**

1. Understand the basic concepts, components, and applications of embedded systems.
2. Apply knowledge of sensors, actuators, and interfaces in embedded hardware design.
3. Develop embedded software using C and implement multitasking with RTOS features.
4. Analyze hardware-software integration and evaluate real-time scheduling methods.
5. Explain IoT architecture and compare common IoT communication protocols.
6. Design simple IoT systems with sensor integration, cloud connectivity, and security.

**Prerequisite:** Basics of microprocessor and micro controller.

Admit 23-24

**DETAILED THEORY SYLLABUS:**

| Sr. No. | Module | Detailed Content | Hours |
|---|---|---|---|
| 1. | **Introduction to Embedded System** | Definition and characteristics of embedded systems, Overview of embedded system applications (industrial, automotive, medical, consumer electronics), Components of embedded systems: hardware (processors, memory, input/output, sensors, actuators), software (firmware, operating systems, application software),Design constraints: performance, cost, power, reliability, safety Embedded system development life cycle, Case studies: Medical monitoring systems, vending machines | 05 |
| 2. | **Embedded System Hardware and Interfacing** | Embedded Memory types, Sensors and actuators: types, interfacing techniques, signal conditioning, Communication interfaces: UART, SPI, I2C, CAN, USB, Power supply considerations: battery technologies, power management, safety, and reliability in embedded design | 06 |
| 3. | Embedded System Software and Programming | Firmware development: C/Embedded C programming, use of IDEs and toolchains,Real-time operating systems (RTOS): concepts, task scheduling, Inter-Task (process) communication: Semaphore, Mailbox, Message queues, Event timers, Task synchronisation- Shared data, Priority inversion, Deadlock. interrupt handling, Hardware-software co-design, device drivers, bootloaders, Program Modelling concepts: DFG,FSM,UML, Debugging and testing embedded software | 08 |
| 4. | **System Integration and Real-Time Applications** | Hardware/software integration: co-design approaches, partitioning, prototyping. Real-time constraints and scheduling algorithms: Rate Monotonic Scheduling, Earliest Deadline First (with numericals), Case studies: Embedded system in automotive, industrial automation, consumer electronics, Introduction to embedded system security. | 07 |
| 5. | **Fundamentals of IoT** | History of IoT, M2M – Machine to Machine, Web of Things, IoT protocols Applications: Remote Monitoring & Sensing, Remote Controlling, Performance Analysis The Architecture The Layering concepts , IoT Communication Pattern, IoT protocol Architecture, Application Protocols MQTT, REST/HTTP, CoAP and 6LoWPAN in IoT. | 07 |
| 6. | **IoT System Design and Applications** | IoT system design: requirements, device/component integration, cloud connectivity, Sensor and actuator interfacing in IoT, Data acquisition, storage, and analytics: cloud storage, databases (SQL/NoSQL), IoT security, Case studies: Smart metering, e-health, automotive applications, smart street lights | 06 |

**DETAILED LAB SYLLABUS:**

Adm. 2024

**Software Requirements:** Keil 5, Raspbian OS

**Hardware Requirements:**

ARM 7 kit / Cortex M3, RPi, peripherals

| Sr. No. | List of Experiments |
|---|---|
| 1 | Two or three programs for GPIO programming with ARM 7 / Cortex M3 |
| 2 | Two Interfacing of communication protocols( I2C,CAN,SPI,zigbee etc) with ARM 7/ Cortex M3 |
| 3 | Simulation of multitasking using RTOS |
| 4 | Inter process communication using semaphore in RTOS |
| 5 | Minimum two Experiments using any hardware platform (Arduino/Raspberry i/BeagleBone/Galileo) for data handling and storage. |
| 6 | Minimum three experiments using any hardware platform (Arduino/Raspberry Pi/BeagleBone/Galileo) for interfacing various sensors and communicating data using Internet using various Protocols. |

**Theory Assessments:**

**1. Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.

**2. End Sem Theory Examination:**

- Question paper will consist of 5 questions, each carrying 20 marks.
- Total 3 questions need to be solved.
- Q.1 will be compulsory, based on the entire syllabus.
- Remaining questions will be randomly selected from all the modules.
- Weightage of marks should be proportional to number of hours assigned to each module.

**Lab Assessment:**

1. **Term work Assessment:**

The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. Equal weightage should be given to laboratory experiments and while assigning term work marks.

2. **Oral/Viva Assessment:**

Oral exam will be based on the entire syllabus.

**Text Books:**


1. Raj Kamal,‖ Embedded Systems Architecture, Programming and design‖, Tata MCgrawHill Publication.
2. Shibu K.V,‖ Introduction to Embedded Systems‖, Mc Graw Hill, 2nd edition.
3. Raj Kamal, “Internet of Things Architecture & Design Principles” Mcgraw Hill


Adm. Y 23-24

4. ArshdeepBahga, Vijay Madisetti, “Internet of Things – A hands-on approach”, Universities Press, 2015.

**References:**

1. Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems, Dr. Ovidiu Vermesan, Dr. Peter Friess, River Publishers.
2. David Simon, ―Embedded systems software primer‘, Pearson
3. K.V.K.K. Prasad, ―Embedded Real Time Systems: Concepts, Design & Programming‖,Dreamtech Publication.

Adm. Y 23-24

| Course Code | Course Name | Scheme | Theory | Practical | Tutorial | Total |
|---|---|---|---|---|---|---|
| IL 360 | Entrepreneurship | Contact Hours | 3 | - | - | 3 |
| | | Credits | 3 | - | - | 3 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal Assessment | | | End Sem Exam | | | | |
| | | IA 1 | IA 2 | Average | | | | | |
| IL 360 | Entrepreneurship | 40 | 40 | 40 | 60 | - | - | -- | 100 |

**Course Objectives:**

1. To understand the basic concepts of entrepreneurship.
2. To understand the role of entrepreneurship in economic development
3. To understand the importance of opportunity recognition and internal and external analyses to the success of a business venture
4. To enable the learners to know the factors contributed in failure of the enterprise

**Course Outcomes:** Learner will be able to

1. Analyse the business environment in order to identify business opportunities
2. Identify the elements of success of entrepreneurial ventures
3. Evaluate the effectiveness of different entrepreneurial strategies,
4. Interpret their own business plan

| Module | Detailed Contents | Hrs |
|---|---|---|
| 1 | Conceptual definition of entrepreneurs and entrepreneurship, Advantages and Disadvantages of Being an Entrepreneur , Entrepreneurial motivation, Entrepreneurial characteristics | 8 |
| 2 | Recognizing, assessment and Exploiting the Opportunity, Conducting Internal and External Analyses, Determining the Feasibility of the Concept, Selecting a Marketing Strategy | 6 |
| 3 | Entrepreneurial Business Types<br>A. Overview of Franchising and Their Advantages and Disadvantages<br>B. Overview of Buyouts & Their Advantages and Disadvantages<br>C. Overview of Family Businesses and Their Advantages and Disadvantages | 6 |
| 4 | The Overall Business Plan, Purpose of the Business Plan, Components of the Business Plan, Presentation of the Business Plan, Matching the Business Plan to the Needs of the Firm | 6 |
| 5 | The Marketing Plan, Conducting a Market Analysis, Understanding the Target Market, Reaching the Target Market through Locale and Engagement | 8 |
| 6 | Entrepreneurial failure, early stage failure, late stage failure | 6 |

**Assessment:**

**Internal Assessment: 40 marks**

1. Consisting of One Compulsory Class Tests of 40 Marks
2. Continuous evaluation: Class Test/ Assignments / Quiz/ Case studies/ Seminar presentation of 40 Marks

AY 23-24

**End Semester Examination: 60 marks**

Weightage of each module in the end semester examination will be proportional to the number of respective lecture hours mentioned in the syllabus.

**Reference Books:**


1. Fundamentals of Entrepreneurship by H. Nandan, PHI
2. Entrepreneurship by Robert Hisrich, Michael Peters, Dean Shepherd, Sabyasachi Sinha, Mc Graw Hill
3. Why startups fail: A new roadmap for entrepreneurial success by Tom Eisenmann


Adm. Y 23-24

| Course Code | Course Name | Scheme | Theory | Practical | Tutorial | Total |
|---|---|---|---|---|---|---|
| IL 361 | E-Commerce and E-Business | Contact Hours | 3 | - | - | 3 |
| | | Credits | 3 | - | - | 3 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal Assessment | | | End Sem Exam | | | | |
| | | IA 1 | IA 2 | Average | | | | | |
| IL 361 | E-Commerce and E-Business | 40 | 40 | 40 | 60 | - | - | -- | 100 |

**Course Objectives:**

1. To understand the factors needed in order to be a successful in ecommerce
2. Identify advantages and disadvantages of technology choices such as merchant server software and electronic payment options.
3. Analyse features of existing e-commerce businesses, and propose future directions or innovations for specific businesses.

**Course Outcomes:** Learner will be able to

1. Appreciate the global nature and issues of electronic commerce as well as understand the rapid technological changes taking place.
2. Define and differentiate various types of E-commerce
3. Discuss various E-business Strategies.

| Module | Detail Content | Hrs. |
|---|---|---|
| 1 | **E-commerce system:** Introduction- scope of electronics commerce, definition of e-commerce, difference between e-commerce and e-business, business models of e-commerce transactions. E-commerce infrastructure: client server technology, two tier client server architecture for e-commerce, drawbacks, three tier architecture for e-commerce. | 8 |
| 2 | **Business strategies for e-commerce:** Introduction- elements of e-commerce strategy, simplicity, mobile responsiveness, choosing e-commerce store platform, user-based focus, compliance and security measures, e-commerce strategy: strategy overview, strategy task, technology issues. Case study: Flipkart v/s Amazon, competitive edge, marketing strategy, sales strategy | 8 |
| 3 | **Design of E-commerce systems:** e-commerce types- electronic market, electronics data interchange EDI, modeling of e-commerce system, three tier component model of e-commerce system, e-commerce system design- data model, web modeling, database structure design, process model, user friendly design of e-commerce site. | 7 |
| 4 | **Technologies for e-commerce systems:** Introduction- technologies for e-commerce, PHS and Java script, SEO, Social Plugins, payment processes, SSL Encryption, hosting server, Service oriented architecture. | 7 |
| 5 | **Scalability of e-commerce systems:** Web scalability- Vertical scalability , horizontal scalability, Load balancing- working of load balancers, global server load balancers, cloud load balancing- goals of cloud balancing, automated cloud balancing. web caching and buffering | 6 |

AY: 2023-24

| | | |
|---|---|---|
| 6 | **E-commerce system implementation:** E-commerce implementation, - website testing, web maintenance, web advertisement, copyright services, SMS alert services, bulk email services, Web personalization- techniques for gathering information, analysis techniques for website personalization, domain name registration and web hosting- different types of web hosting, different components of web hosting, features in web hosting. | 6 |

**Assessment:**

**Internal Assessment: 40 marks**

1. Consisting of One Compulsory Class Tests of 40 Marks
2. Continuous evaluation: Class Test/ Assignments / Quiz/ Case studies/ Seminar presentation of 40 Marks

**End Semester Examination: 60 marks**

Weightage of each module in the end semester examination will be proportional to the number of respective lecture hours mentioned in the syllabus.

**Reference Books:**


1. Electronic Business and Electronic Commerce Management, 2nd edition, Dave Chaffey, Prentice Hall, 2006
2. Elias. M. Awad, " Electronic Commerce", Prentice-Hall of India Pvt Ltd.
3. E-Commerce Strategies, Technology and applications (David Whitley) Tata McGrawHill
4. E-business- theory and practise, Brahm Canzer, cengage learning
5. Secure e-commerce systems (Kindle edition), Amazon publishing, P S Lokhande, B B Meshram, first edition


Adm. Y 23-24

| Course Code | Course Name | Scheme | Theory | Practical | Tutorial | Total |
|---|---|---|---|---|---|---|
| IL 362 | Research Methodology | Contact Hours | 3 | - | - | 3 |
| | | Credits | 3 | - | - | 3 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal Assessment | | | End Sem Exam | | | | |
| | | IA 1 | IA 2 | Average | | | | | |
| IL 362 | Research Methodology | 40 | 40 | 40 | 60 | - | - | -- | 100 |

**Course Objectives:**

1. To understand Research and Research Process
2. To acquaint students with identifying problems for research and develop research strategies
3. To familiarize students with the techniques of data collection, analysis of data and interpretation

**Course Outcomes:** At the end of the course learner will be able to

1. Prepare a preliminary research design for projects in their subject matter areas.
2. Accurately collect, analyse and report data.
3. Present complex data or situations clearly.
4. Review and analyse research findings.

| Module | Detail Content | Hrs. |
|---|---|---|
| 1 | **Introduction and Basic Research Concepts**<br>1.1 Research – Definition; Concept of Construct, Postulate, Proposition, Thesis, Hypothesis, Law, Principle. Philosophy and validity of research<br>1.2 Objectives of Research<br>1.3 Characteristics of Research: Systematic, Valid, Verifiable, Empirical and Critical<br>1.4 Need of Research in Business and Social Sciences<br>1.5 Issues and Problems in Research | 8 |
| 2 | **Types of Research**<br>2.1. Pure and Applied Research<br>2.2. Descriptive and Explanatory Research<br>2.3. Analytical Research<br>2.4 Qualitative and Quantitative Approaches<br>2.5 Literature review<br>2.6 Developing the objectives. | 8 |
| 3 | **Research Design and Sample Design**<br>3.1 Research Design – Meaning, Types and Significance<br>3.2 Sample Design – Meaning and Significance Essentials of a good sampling Stages in Sample Design Sampling methods/techniques Sampling Errors | 7 |
| 4 | **Research Methodology**<br>4.1 Meaning of Research Methodology | 8 |

Apply 23-24

| | | |
|---|---|---|
| | 4.2. Stages in Scientific Research Process:<br>a. Identification and Selection of Research Problem<br>b. Formulation of Research Problem<br>c. Review of Literature<br>d. Formulation of Hypothesis<br>e. Formulation of research Design<br>f. Sample Design<br>g. Data Collection<br>h. Data Analysis<br>i. Hypothesis testing and Interpretation of Data<br>j. Preparation of Research Report | |
| 5 | **Formulating Research Problem**<br>5.1 Considerations: Relevance, Interest, Data Availability, Choice of data, Analysis of data, Generalization and Interpretation of analysis. | 4 |
| 6 | **Outcome of Research**<br>6.1 Preparation of the report on conclusion reached.<br>6.2 Validity Testing & Ethical Issues<br>6.3 Suggestions and Recommendation<br>6.4 Identification of future scope | 4 |

**Assessment:**

**Internal Assessment: 40 marks**

1. Consisting of One Compulsory Class Tests of 40 Marks
2. Continuous evaluation: Class Test/ Assignments / Quiz/ Case studies/ Seminar presentation of 40 Marks

**End Semester Examination: 60 marks**

Weightage of each module in the end semester examination will be proportional to the number of respective lecture hours mentioned in the syllabus.

**Books/References:**


1. Dawson, Catherine, 2002, Practical Research Methods, New Delhi, UBS Publishers Distributors.
2. Kothari, C.R.,1985, Research Methodology-Methods and Techniques, New Delhi, Wiley Eastern Limited.
3. Kumar, Ranjit, 2005, Research Methodology-A Step-by-Step Guide for Beginners, (2nded), Singapore, Pearson Education


Acad. Yr 23-24

| Course Code | Course Name | Scheme | Theory | Practical | Tutorial | Total |
|---|---|---|---|---|---|---|
| IL 363 | Introduction to Bioengineering | Contact Hours | 3 | - | - | 3 |
| | | Credits | 3 | - | - | 3 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal Assessment | | | End Sem Exam | | | | |
| | | IA 1 | IA 2 | Average | | | | | |
| IL 363 | Introduction to Bioengineering | 40 | 40 | 40 | 60 | - | - | -- | 100 |

**Course Objectives:**

1. To understand and analyze the human body as a mechanical assembly of linkages and describe the fundamentals of biomechanics.
2. To Study the deformability, strength, visco elasticity of bone and flexible tissues, modes of loading and failure and describe the types and mechanics of skeletal joints.
3. To describe movement precisely, using well defined terms (kinematics) and also to consider the role of force in movement (kinetics).
4. To teach students the unique features of biological flows, especially constitutive laws and boundaries.
5. To teach students approximation methods in fluid mechanics and their constraints.
6. To consider the mechanics of orthopedic implants and joint replacement , mechanical properties of blood vessels and Alveoli mechanics

**Course Outcomes:** Learner will be able to

1. Apply a broad and coherent knowledge of the underlying principles and concepts of biomechanics, particularly in the fields of kinematics and kinetics as applied to human and projectile motion.
2. Understand and describe the properties of blood , bone and soft tissues like articular cartilage tendons and ligaments.
3. Gain broad knowledge about the mechanics of moving systems and familiarity with human anatomy to competently analyze gross movement of the human body.
4. Be able to computationally analyze the dynamics of human movement from the most commonly used measurement devices in the field, such as motion capture and force platform systems.
5. Use knowledge gained to competently interpret the current understanding of human movement and present recommendations for further study.

Adm Yr 23-24

| Module | Detail Content | Hrs. |
|---|---|---|
| 1 | **Introduction:** Definition of Biomechanics, Selected Historical highlights, The Italian Renaissance, Gait century, Engineering Physiology & Anatomy | 6 |
| 2 | **Biomedical Instrumentation:** Patient monitoring system, Arrythmia and ambulatory monitoring instrumentation, cardiac pacemakers, cardiac defibrillators, physiotherapy and electrotherapy equipment, ventilators | 8 |
| 3 | **Medical Image Processing:** Introduction to X-rays based imaging systems, Magnetic Resonance Imaging (MRI), Positron Emission Tomography (PET), Single-Photon Emission Computerized Tomography (SPECT) scan, Computed Tomography (CT) scan and Ultrasound (sonography) | 7 |
| 4 | **Biomaterials:** Brief Anatomy, Bone, cartilage, ligament, tendon, Muscles, biofluid their physical properties | 6 |
| 5 | **Implants:** General concepts of Implants, classification of implants, Soft tissues | 6 |
| 6 | Application of advanced engineering techniques to the human body, case studies. | 6 |

**Assessment:**
Internal Assessment: 40 marks
End Semester Examination: 60 Marks

**Books/References:**


1. Nigg, B.M.and Herzog, W., "BIOMECHANICS of Musculo skeleton system", John Willey & Sons, 1st Edition.
2. Saltzman, W.L., "BIOMEDICAL ENGINEERING: Bridging medicine and Technology", Cambridge Text, First Edition.
3. Winter, D., "BIOMECHANICS and Motor Control of Human Movement", WILEY Interscience Second edition
4. "Biomedical Instrumentation and Measurements" by Leslie Cromwell, Fred J. Weibell, and Erich A. Pfeiffer
5. W. Birkfellner, Applied Medical Image Processing: A Basic Course, CRC Press , Second Edition, 2014
6. Prof. Ghista, Biomechanics, Private Publication UAF, 2009
7. White & Puyator, Biomechanics, Private publication UAE, 2010
8. R. M. Kennedy, A textbook of Biomedical Engineering, GTU, 2010
9. Richard Shalak & Shu Chien, Handbook of Bioengineering,
10. Sean P. Flanagan, Flanagan, Biomechanics: A case based Approach, Jones & Bartlett Publishers, 2013
11. Y. C. Fung, Yuan-Cheng Fung, Biomechanics: mechanical Property of living Tissue, Springer, 1996.
12. Carol A. Oatis, The Mechanics and Pathomechanics of Human Movement, Lippincott Williams & Wilkins, 2010


Adm. Y 23-24

| Course Code | Course Name | Scheme | Theory | Practical | Tutorial | Total |
|---|---|---|---|---|---|---|
| IL 364 | Biomedical Instrumentation | Contact Hours | 3 | - | - | 3 |
| | | Credits | 3 | - | - | 3 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal Assessment | | | End Sem Exam | | | | |
| | | IA 1 | IA 2 | Average | | | | | |
| IL 364 | Biomedical Instrumentation | 40 | 40 | 40 | 60 | - | - | -- | 100 |

**Course Objectives:**

1. Develop a fundamental understanding of human physiology and anatomy to comprehend the sources of biomedical signals and their role in medical diagnosis and treatment.
2. Understand the origin and characteristics of bioelectric signals and learn about the various types of electrodes, biosensors, smart sensors, and biomedical recorders used in healthcare.
3. Gain knowledge of biomaterials, bone structure, composition, and the biomechanics of soft tissues and joints, as well as their applications in implants, prosthetics, and orthotics.
4. Learn about the operation and application of diagnostic instruments
5. Understand the principles and applications of therapeutic instruments
6. Study the integration of AI in healthcare

**Course Outcomes:** Learner will be able to

1. Explain the fundamentals of human physiology and anatomy and identify the sources of biomedical signals critical to medical diagnostics and instrumentation.
2. Analyze the structure and properties of biomaterials, bones, soft tissues, and joints, and evaluate their applications in developing implants, prosthetics, and orthotic devices.
3. Describe the principles, design, and functionality of basic and intelligent medical instrumentation systems.
4. Assess the functionality and clinical applications of diagnostic instruments.
5. Explain the working principles and applications of therapeutic instruments.
6. Illustrate the role of artificial intelligence in healthcare.

Adm Y 23-24

| Module | Detail Content | Hrs |
|---|---|---|
| 1 | **Fundamentals of Bioengineering:** A brief on human physiology and anatomy, sources of biomedical signals, basic medical instrumentation system, intelligent medical instrumentation systems, regulation of medical devices. | 6 |
| 2 | **Biomaterials and Biomechanics:** Introduction to biomaterials, Bone structure & composition, Structure and functions of Soft Tissues, types of joint , Implants, Prosthetics and orthotics. | 6 |
| 3 | **Bioelectric signals and electrodes:** Origin of Bioelectrical signals, Recording electrodes, Microelectrodes, Biosensors, Smart Sensors, Biomedical recorders. | 8 |
| 4 | **Introduction to Diagnostics Instruments:** Patient monitoring system, Arrythmia and ambulatory monitoring instrumentation, oximeters, Blood flowmeter, Cardiac output measurement, Pulmonary analyzers, Blood gas analyzers, Blood cell counters. | 7 |
| 5 | **Introduction to Therapeutic Instruments:** cardiac pacemakers, cardiac defibrillators, instruments for surgery, physiotherapy and electrotherapy equipment, hemodialysis machine, ventilators | 6 |
| 6 | **AI for Health care:** Medical Imaging, Surgical Assistance, Personalized medicine, Wearable Devices and monitoring, Healthcare management system | 6 |

**Assessment:**
Internal Assessment: 40 marks
End Semester Examination: 60 Marks

**Books/References:**


1. "Handbook of Biomedical Instrumentation" by R. S. Khandpur
2. "Biomedical Instrumentation and Measurements" by Leslie Cromwell, Fred J. Weibell, and Erich A. Pfeiffer
3. "Medical Instrumentation: Application and Design" by John G. Webster
4. "Biomechanics: Principles and Applications" by Donald R. Peterson and Joseph D. Bronzino
5. "Deep Medicine: How Artificial Intelligence Can Make Healthcare Human Again" by Eric Topol


Adm. Y23-24

| Course Code | Course Name | Scheme | Theory | Practical | Tutorial | Total |
|---|---|---|---|---|---|---|
| IL 365 | Design of Experiments | Contact Hours | 3 | - | - | 3 |
| | | Credits | 3 | - | - | 3 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal Assessment | | | End Sem Exam | | | | |
| | | IA 1 | IA 2 | Average | | | | | |
| IL 365 | Design of Experiments | 40 | 40 | 40 | 60 | - | - | -- | 100 |

**Course Objectives:**

1. To understand the issues and principles of Design of Experiments (DOE)
2. To list the guidelines for designing experiments
3. To become familiar with methodologies that can be used in conjunction with experimental designs for robustness and optimization

**Course Outcomes:** Learner will be able to…

1. Fundamentals of experiments and its uses
2. Basic statistics including ANOVA and regression
3. Experimental designs such as RCBD, BIBD, Latin square, factorial and fractional factorial designs.
4. Apply statistical models in analyzing experimental data
5. RSM to optimize response of interest from an experiment
6. Use software such as Minitab

| Module | Detailed Contents | Hrs |
|---|---|---|
| 1 | **Introduction**<br>1. Why experiment?<br>2. Terms and Component of Experiment<br>3. Experimental Units and Responses<br>4. Types of Data ,Plots and Charts<br>5. Importance of Product Reliability<br>6. Uncertainty of Measurement<br>7. Classification of DOE<br>8. Software for DOE<br>9. Principle of Experimental Design<br>10. Types of Experimental Design | 08 |
| 2 | **Basic Statistics and ANOVA**<br>1. Random Variable and Probability Distribution<br>2. Normal Distribution<br>3. Sampling Distribution<br>4. Estimation | 08 |

Adm. AY 23-24

| | | |
|---|---|---|
| | 5. Hypothesis Testing<br>6. Determination of Sample size<br>7. Analysis of Variance(ANOVA)<br>8. Estimation of model parameters and Adequacy test<br>9. ANOVA-Pair wise comparison and Tukey's and Fishers LSD test<br>10. Two way ANOVA<br>11. Multi way ANOVA<br>12. Determination of Sample Size for ANOVA | |
| 3 | **Regression**<br>1. Introduction to Multiple Linear Regression(MLR)<br>2. Sampling distribution of Regression coefficients<br>3. MLR: Hypothesis testing and Model Adequacy Test<br>4. MLR:Diagnostic and Testing for Lack of Fit<br>5. Regression approach to ANOVA | 07 |
| 4 | **Experimental Designs**<br>1. Randomized Complete block design (RCBD)<br>2. RCBD-Estimation of Parameters<br>3. RCBD-Balanced Incomplete block design(BIBD)<br>4. RCBD-Latin square design<br>5. Introduction to Factorial Design<br>6. Statistical Analysis of Factorial Design<br>7. Estimation of parameters and Model Adequacy test<br>8. Full factorial design<br>9. Two level factorial design<br>10. Statistical Analysis of the $2^k$ Design<br>11. Blocking and Confounding in the $2^k$ Design<br>12. Fractional Factorial Design | 08 |
| 5 | **Response Surface Methods and Designs**<br>1. Introduction to Response Surface Methodology<br>2. RSM-First order model<br>3. Experimental design for fitting Response Surfaces<br>4. RSM-Fitting Second order model<br>5. Analysis of Second order RSM | 06 |
| 6 | **Taguchi Approach**<br>1. Crossed Array Designs and Signal-to-Noise Ratios<br>2. Analysis Methods<br>3. Robust design examples | 04 |

**Assessment:**
**Internal Assessment: 40 marks**

1. Consisting of One Compulsory Class Tests of 40 Marks
2. Continuous evaluation: Class Test/ Assignments / Quiz/ Case studies/ Seminar presentation of 40 Marks

Adm. Y 23-24

**End Semester Examination: 60 marks**

Weightage of each module in the end semester examination will be proportional to the number of respective lecture hours mentioned in the syllabus.

**Books/References:**


1. Raymond H. Mayers, Douglas C. Montgomery, Christine M. Anderson-Cook, Response Surface Methodology: Process and Product Optimization using Designed Experiment, 3rd edition,John Wiley & Sons, New York, 2001
2. D.C. Montgomery, Design and Analysis of Experiments, 5th edition, John Wiley & Sons, New York, 2001
3. George E P Box, J Stuart Hunter, William G Hunter, Statistics for Experimenters: Design, Innovation and Discovery, 2 nd Ed. Wiley
4. W J Diamond, Practical Experiment Designs for Engineers and Scientists, John Wiley and Sons Inc. ISBN: 0-471-39054-2
5. Design and Analysis of Experiments (Springer text in Statistics), Springer by A.M. Dean, and D. T.Voss


Adm. Y 23-24

| Course Code | Course Name | Scheme | Theory | Practical | Tutorial | Total |
|---|---|---|---|---|---|---|
| IL 366 | Design for Sustainability | Contact Hours | 3 | - | - | 3 |
| | | Credits | 3 | - | - | 3 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal Assessment | | | End Sem Exam | | | | |
| | | IA 1 | IA 2 | Average | | | | | |
| IL 366 | Design for Sustainability | 40 | 40 | 40 | 60 | - | - | -- | 100 |

**Course Objectives:**

1. Understand the complex environmental, economic, and social issues related to sustainable engineering
2. Become aware of concepts, analytical methods/models, and resources for evaluating and comparing sustainability implications of engineering activities
3. Critically evaluate existing and new methods
4. Develop sustainable engineering solutions by applying methods and tools to research a specific system design
5. Clearly communicate results related to their research on sustainable engineering

**Course Outcomes:** Learner will be able to

1. Account for different theoretical and applied design principles and models for sustainable design
2. Account for and critically relate to sustainable design from an ethical, cultural and historical perspective
3. Critically review different design solutions ecological, social and economical consequences, risks, possible uses and functions in the work for a sustainable development
4. Independently apply a specific design theory on a specific challenge within the sustainability field.

| Module | Detailed Contents | Hrs |
|---|---|---|
| 1 | Introduction - Need, Evolution of sustainability within Design, environmental - economic sustainability concept, Challenges for sustainable development, Environmental agreement & protocols | 6 |
| 2 | Product Life Cycle Design – Life Cycle Assessment, Methods & Strategies, Software Tools | 6 |
| 3 | Sustainable Product - Service System Design, Definition, Types & Examples ,Transition Path and Challenges, Methods and Tools, Design thinking and design process for sustainable development | 8 |
| 4 | Design for Sustainability – Engineering Design Criteria and Guidelines | 6 |
| 5 | Design for Sustainability – Architecture, Agriculture, Cities & Communities, Carbon Footprint | 6 |
| 6 | Green Building Technologies - Necessity, Principles, low energy materials, effective systems | 6 |

AY 23-24

**Assessment:**

**Internal Assessment: 40 marks**

1. Consisting of One Compulsory Class Tests of 40 Marks
2. Continuous evaluation: Class Test/ Assignments / Quiz/ Case studies/ Seminar presentation of 40 Marks

**End Semester Examination: 60 marks**

Weightage of each module in the end semester examination will be proportional to the number of respective lecture hours mentioned in the syllabus.

**Books/References:**


1. C. Vezzoli, System Design for sustainability. Theory, methods and tools for a sustainable / satisfaction system/design, Rimini, Maggioli Edition, 2007.
2. C. Vezzoli and E. Manzini, Design for Environmental Sustainability, Springer – Verlag, London, 2008.
3. L. Nin and C. Vezzoli, Designing Sustainable Product-Service Systems for all. Milan: Libreria, CLUP, 2005
4. A. Tukker and U. Tischner (eds.), New Business for Old Europe, Product Services, Sustainability and Competitiveness, Greenleaf Publishing, Shefield, 2008.
5. A. Tukker, M. Charter, C. Vezzoli, E. Sto and M.M. Andersen (eds.), System innovation for Sustainability Perspective on Radical Changes to sustainable consumption and production, Greenleaf Publishing, Shefield, 2008
6. UNEP, Product-Service Systems and Sustainability. Opportunities for sustainable solutions, CEDEX, Paris, 2002, at http://www.uneptie.org/pc/sustain/reports/pss/pss-imp-7.pdf


Adm. Y 2024

| Course Code | Course Name | Scheme | Theory | Practical | Tutorial | Total |
|---|---|---|---|---|---|---|
| IL 367 | Political Science | Contact Hours | 3 | - | - | 3 |
| | | Credits | 3 | - | - | 3 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal Assessment | | | End Sem Exam | | | | |
| | | IA 1 | IA 2 | Average | | | | | |
| IL 367 | Political Science | 40 | 40 | 40 | 60 | - | - | -- | 100 |

**Course Objectives:**

1. Provide a good grounding in the basic concepts of Political Theory.
2. Familiarize learners with fundamental rights and duties.
3. Teach students the structure and process of the electoral system, the features and trends of the party system and create an awareness of the social movements in India.
4. To inculcate the values of renowned thinkers on law, freedom of thought and social justice.
5. To prepare the learners for understanding the importance of Comparative Government and Politics.
6. To train learners in understanding International Relations.

**Course Outcomes:** Learner will be able to

1. Acquire conceptual and theoretical knowledge in the basic concepts of political theory.
2. Demonstrate understanding of fundamental rights and duties and directive principles.
3. Perform successfully in expressing the process of the electoral system, the features and trends of the party system and the importance of the social movements in India.
4. Illustrate the contribution of renowned thinkers and relate it to the current scenario.
5. Compare and contrast Indian Government and Politics with European countries.
6. Develop an understanding of International Relations with respect to Indian foreign policy.

| Module | Detail Content | Hrs. |
|---|---|---|
| 1 | Understanding Political Theory- Evolution of State, Nation, Sovereignty, Types and Linkages between Power and Authority; Interrelationships between Law. Liberty, Equality, Rights; Justice and Freedom, Democracy vs Authoritarianism | 4 |
| 2 | Constitutional Government in India - Evolution of the Indian Constitution, Fundamental Rights and Duties. Directive Principles. Union-State Relations, Union Legislature: Rajya Sabha, Lok Sabha: Organisation, Functions – Law making procedure, Parliamentary procedure, Government in states: Governor, Chief Minister and Council of Ministers: position and functions – State Legislature: composition and functions. Judiciary: Supreme Court and the High Courts: composition and functions – Judicial activism. Constitutional amendment. Major recommendations of National Commission to Review the Working of the Constitution. | 6 |

Ad hoc 2023-24

| | | |
|---|---|---|
| 3 | Politics in India: Structures and Processes- Party system: features and trends – major national political parties in India: ideologies and programmes. Coalition politics in India: nature and trends. Electoral process: Election Commission: composition, functions, role. Electoral reforms. Role of business groups, working class, peasants in Indian politics, Role of (a) religion (b) language (c) caste (d) tribe. Regionalism in Indian politics. New Social Movements since the 1970s: (a) environmental movements (b) women's movements (c) human rights movements. | 6 |
| 4 | Indian Political Thought- Ancient Indian Political ideas: overview. Kautilya: Saptanga theory, Dandaniti, Diplomacy. Medieval political thought in India: overview (with reference to Barani and Abul Fazal). Legitimacy of kingship. Principle of Syncretism, Modern Indian thought: Rammohun Roy as pioneer of Indian liberalism – his views on rule of law, freedom of thought and social justice. Bankim Chandra Chattopadhyay, Vivekananda and Rabindranath Tagore: views on nationalism. M.K. Gandhi: views on State, Swaraj, Satyagraha. | 7 |
| 5 | Comparative Government and Politics- Evolution of Comparative Politics. Scope, purposes and methods of comparison. Distinction between Comparative Government and Comparative Politics. | 6 |
| 6 | Perspectives on International Relations- Understanding International Relations: outline of its evolution as academic discipline. Major theories: (a) Classical Realism and Neo-Realism (b) Dependency (c) World Systems theory. Emergent issues: (a) Development (b) Environment (c) Terrorism (d) Migration. Making of foreign policy. Indian foreign policy: major phases: 1947-1962; 1962-1991; 1991-till date. Sino-Indian relations; Indo-US relations. | 7 |

**Assessments:**

**Internal Assessment: 40 marks**

1. Consisting of One Compulsory Class Tests of 40 Marks
2. Continuous evaluation: Class Test/ Assignments / Quiz/ Case studies/ Seminar presentation of 40 Marks

**End Semester Examination: 60 marks**

Weightage of each module in the end semester examination will be proportional to the number of respective lecture hours mentioned in the syllabus.

**Books/References:**


1. O.P. Gauba. (2021). *An Introduction to Political Theory*. Mayur books
2. Vibhuti Bhushan Mishra. (1987). *Evolution of the Constitutional History of India (1773-1947 : With Special Reference to the Role of the Indian National Congress and the Minorities).* South Asia Books
3. Chetna Sharma Pushpa Singh. (2019). *Comparative Government and Politics.* SAGE Publications India Pvt Ltd.
4. Henry R. Nau. (1900). *Perspectives on International Relations: Power, Institutions and Ideas*. CQ Press

| Course Code | Course Name | Scheme | Theory | Practical | Tutorial | Total |
|---|---|---|---|---|---|---|
| IL 368 | Visual Art | Contact Hours | 3 | - | - | 3 |
| | | Credits | 3 | - | - | 3 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal Assessment | | | End Sem Exam | | | | |
| | | IA 1 | IA 2 | Average | | | | | |
| IL 368 | Visual Art | 40 | 40 | 40 | 60 | - | - | -- | 100 |

**Course Objectives:**

1. To enable learners to develop aesthetic judgement, visual perception, critical thinking skills in the different forms of art and understand its application.
2. To promote the concept of visual design and understand the different meanings assigned to colours, its impact and problems.
3. To provide the opportunity and scope to use the image editing software for creating images for Web and Video.
4. To inculcate the basic skills required in drawing and painting through exposure in nature and study of still objects.
5. To train students to express their feelings and write imaginatively.
6. To prepare the learners for the use of clay modelling techniques and its industrial applications.

**Course Outcomes:** Learner will be able to

1. Acquire the skills necessary for aesthetic judgement, visual perception and critical thinking required in different forms of art.
2. Demonstrate the understanding of the concept of visual design with respect to the different meanings assigned to colours and the problems associated.
3. Illustrate effective use of image editing software for creating images for the Web and Video.
4. Determine the importance of drawing and painting with respect to nature and still objects.
5. Perform successfully in expressing their feelings creatively.
6. Develop the techniques required for clay modelling and sculpture for industrial use.

| Module | Detail Content | Hrs. |
|---|---|---|
| 1 | History of Art and Architecture- Changing needs and forms of art from the Palaeolithic period to The Renaissance period with special reference to Roman, Indian and Chinese art | 4 |
| 2 | Introduction and concepts of visual design with special emphasis on the psychological impact of colour | 5 |
| 3 | Introduction to image editing software, tools, application and creating Images for Web and Video. With special reference to Adobe Photoshop | 7 |
| 4 | Fundamentals of Drawing- study of forms in nature, study of objects and study from life, creative painting- basic techniques, tools and equipment, medium of painting. | 6 |
| 5 | Creative writing- Movie critique, book reviews, Poems, short plays and skits, Humorous Essays, Autobiography and short stories. | 7 |

Adm. Y 23-24

| | | |
|---|---|---|
| 6 | Creative sculpture- Introduction to clay modelling techniques, study of natural and man-made objects in clay, Sculpture with various materials - Relief in Metal Sheets – Relief on Wood – Paper Pulp - Thermocol. Sculpture with readymade materials. | 7 |

**Assessments:**
Internal Assessment: 40 marks
End Semester Examination: 60 marks
.

**Reference Books:**


1. Gill Martha. (2000). Color Harmony Pastels: A Guidebook for Creating Great Color Combinations. Rockport Publishers.
2. Janson, Anthony F. (1977). History of art, second edition, H.W. Janson. Instructor's manual. Englewood Cliffs, N.J.: Prentice-Hall.
3. Brommer, Gerald F. (1988). Exploring Drawing. Worcester, Massachusetts: Davis Publications.
4. Wendy Burt Thomas. (2010). The Everything Creative Writing Book: All you need to know to write novels, plays, short stories, screenplays, poems, articles, or blogs: All You Need ... - Stories, Screenplays, Blogs and More. Fw Media; 2nd edition.
5. Élisabeth Bonvalot. (2020). Sculpting Book: A Complete Introduction to Modeling the Human Figure.


Adm. Y 2

| Course Code | Course Name | Scheme | Theory | Practical | Tutorial | Total |
|---|---|---|---|---|---|---|
| IL 369 | Modern Day Sensor Physics | Contact Hours | 3 | - | - | 3 |
| | | Credits | 3 | - | - | 3 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal Assessment | | | End Sem Exam | | | | |
| | | IA 1 | IA 2 | Average | | | | | |
| IL 369 | Modern Day Sensor Physics | 40 | 40 | 40 | 60 | - | - | -- | 100 |

**Course Objectives:**

1. Acquire knowledge about the principles and analysis of sensors.
2. Emphasis on characteristics and response of micro sensors.
3. Acquire adequate knowledge of different transducers and Actuators.
4. Learn about the Micro sensors and Micro actuators.
5. Selection of sensor materials for fabrication for different applications

**Course Outcomes:** On successful completion of course learner/student will be able to:

1. Analyze the basics and design the resistive sensors.
2. Identify the materials and designing of inductive and Capacitive Sensors.
3. Analyze various types of Actuators.
4. Design Micro sensors and Micro Actuators for various applications.
5. Implement fabrication process and technologies and compare various Micro machining processes

| Module | Detail Content | Hrs. |
|---|---|---|
| 1 | **Fundamentals of Sensors :** Difference Between Sensor, Transducer And Actuators- Classification Of Sensors: Proprioceptive And Exteroceptive – Active And Passive– Contact And Non-Contact, Selection And Characteristics: Range; Resolution, Sensitivity, Error, Repeatability, Linearity And Accuracy, Primary Sensing Elements. | 6 |
| 2 | **Temperature sensors:**<br>Principle of operation, construction details, characteristics and applications of Bimetallic thermometer, Resistance thermometer, Thermistor, Thermocouples and Total radiation Pyrometers | 8 |
| 3 | **Strain, Force, Torque and Pressure Sensors**<br>Strain gauges, strain gauge beam force sensor, piezoelectric force sensor, load cell, torque sensor, Piezo- resistive and capacitive pressure sensor, Manometer, vacuum sensors, Pirani gauge. | 6 |
| 4 | **Displacement, Level and Flow Sensors** | 8 |

Adm. Y23-24

| | | |
|---|---|---|
| | **Displacement Sensors:** LVDT, RVDT, eddy current, transverse inductive, Hall Effect, magneto resistive, magnetostrictive sensors.<br>**Liquid level sensor**: Fabry Perot sensor, ultrasonic sensor, capacitive liquid level sensor.<br>**Flow sensors**: pressure gradient technique, ultrasonic, electromagnetic sensors and Hot wire anemometer. Micro flow sensor, Coriolis mass flow and drag flow sensor. | |
| 5 | **Micro Machining Technologies**<br>Overview of silicon processes techniques, Photolithography, Ion Implantation, and Diffusion, Chemical Vapor Deposition, Physical vapor Deposition, Epitaxy, Etching, Bulk micromachining, Surface Micromachining, LIGA and other techniques. | 6 |
| 6 | **Actuators**<br>Definition, types and selection of Actuators; linear; rotary; Logical and Continuous Actuators, Pneumatic actuator, Hydraulic actuator - Control valves and cylinders<br>Electrical actuating systems: Solenoids, Electric Motors- D.C motors - AC motors - Three Phase Induction<br>Motor, Stepper motors -Piezoelectric Actuator. | 5 |

**Assessment:**

**Internal Assessment: 40 marks**

1. Consisting of One Compulsory Class Tests of 40 Marks
2. Continuous evaluation: Class Test/ Assignments / Quiz/ Case studies/ Seminar presentation of 40 Marks

**End Semester Examination: 60 marks**

Weightage of each module in the end semester examination will be proportional to the number of respective lecture hours mentioned in the syllabus.

**Books/Reference:**


1. Robert H Bishop, “The Mechatronics Hand Book”, CRC Press, 2002.
2. Thomas. G. Bekwith and Lewis Buck.N, “Mechanical Measurements”, Oxford and IBH publishing Co. Pvt. Ltd.,
3. Massood Tabib and Azar, “Microactuators Electrical, Magnetic, thermal, optical, mechanical, chemical and smart structures”, First edition, Kluwer academic publishers, Springer, 1999.
4. Manfred Kohl, Shape Memory Actuators, first edition, Springer.
5. Patranabis.D, Sensors and Transducers, Wheeler publisher, 1994.


Adm. Y 23-24

| Course Code | Course Name | Scheme | Theory | Practical | Tutorial | Total |
|---|---|---|---|---|---|---|
| IL 370 | Energy Audit and Management | Contact Hours | 3 | - | - | 3 |
| | | Credits | 3 | - | - | 3 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal Assessment | | | End Sem Exam | | | | |
| | | IA 1 | IA 2 | Average | | | | | |
| IL 370 | Energy Audit and Management | 40 | 40 | 40 | 60 | - | - | -- | 100 |

**Course Objectives:**

1. To impart basic knowledge to the students about current energy scenario, energy conservation, audit and management.
2. To inculcate among the students systematic knowledge and skill about assessing the energy efficiency, energy auditing and energy management.
3. To introduce performance evaluation criteria of various electrical and thermal installations to facilitate the energy management
4. To relate the data collected during performance evaluation of systems for identification of energy saving opportunities.

**Course Outcomes:** Upon successful completion of this course, the learner will be able to

1. To identify and describe the present state of energy security and its importance.
2. To identify and describe the basic principles and methodologies adopted in energy audit of an utility
3. To describe the energy performance evaluation of some common electrical installations and identify the energy saving opportunities.
4. To describe the energy performance evaluation of some common thermal installations and identify the energy saving opportunities.
5. To analyze the data collected during performance evaluation and recommend energy saving measures

| Module | Detail Content | Hrs. |
|---|---|---|
| 1 | **Energy Scenario:**<br>Energy needs of growing economy, Long term energy scenario, Energy pricing, Energy sector reforms, Energy and environment: Air pollution, Climate change, Energy security, Energy conservation and its importance, Energy strategy for the future, Energy conservation Act2001 and its features. | 4 |
| 2 | **Energy Management and Audit:**<br>Definition, Energy audit- need, Types of energy audit, Energy management (audit) approach-understanding energy costs, Bench marking, Energy performance, Matching energy use to requirement, Maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution, Energy audit instruments. | 10 |

AY 23-24

| | | |
|---|---|---|
| | **Material and Energy balance:**<br>Facility as an energy system, Methods for preparing process flow, Material and energy balance diagrams.<br>**Financial Management:**<br>Investment-need, Appraisal and criteria, Financial analysis techniques- Simple payback period, Return on investment, Net present value, Internal rate of return, Cash flows, Risk and sensitivity analysis, Financing options, Energy performance contracts and role of ESCOs | |
| 3 | **Energy Management and Energy Conservation in Electrical System:**<br>Electricity billing, Electrical load management and maximum demand Control; Power factor improvement, Energy efficient equipments and appliances, star ratings. Energy efficiency measures in lighting system, Lighting control: Occupancy sensors, daylight integration, and use of intelligent controllers. Energy conservation opportunities in: water pumps, industrial drives, induction motors, motor retrofitting, soft starters, variable speed drives. | 10 |
| 4 | **Energy Management and Energy Conservation in Thermal Systems:**<br>Review of different thermal loads; Energy conservation opportunities in: Steam distribution system, Assessment of steam distribution losses, Steam leakages, Steam trapping, Condensate and flash steam recovery system. General fuel economy measures in Boilers and furnaces, Waste heat recovery, use of insulation- types and application. HVAC system: Coefficient of performance, Capacity, factors affecting Refrigeration and Air Conditioning system performance and savings opportunities. | 10 |
| 5 | **Energy Performance Assessment: On site Performance evaluation techniques, Case studies based on:**<br>Motors and variable speed drive, pumps, HVAC system calculations; Lighting System: Installed Load Efficacy Ratio (ILER) method, Financial Analysis. | 3 |
| 6 | **Energy conservation in Buildings: Energy Conservation Building Codes (ECBC):**<br>Green Build Building, LEED rating, Application of NonConventional and Renewable Energy Sources | 3 |

Adm. Y 23-24

**Assessment:**

**Internal Assessment: 40 marks**

1. Consisting of One Compulsory Class Tests of 40 Marks
2. Continuous evaluation: Class Test/ Assignments / Quiz/ Case studies/ Seminar presentation of 40 Marks

**End Semester Examination: 60 marks**

Weightage of each module in the end semester examination will be proportional to the number of respective lecture hours mentioned in the syllabus.

**Books/References:**


1. Handbook of Electrical Installation Practice, Geofry Stokes, Blackwell Science
2. Designing with light: Lighting Handbook, By Anil Valia, Lighting System
3. Energy Management Handbook, By W.C. Turner, John Wiley and Sons
4. Handbook on Energy Audits and Management, edited by A. K. Tyagi, Tata Energy Research Institute (TERI).
5. Energy Management Principles, C.B.Smith, Pergamon Press
6. Energy Conservation Guidebook, Dale R. Patrick, S. Fardo, Ray E. Richardson, Fairmont Press
7. Handbook of Energy Audits, Albert Thumann, W. J. Younger, T. Niehus, CRC Press


Adm. Y 23-24

| Course Code | Course Name | Scheme | Theory | Practical | Tutorial | Total |
|---|---|---|---|---|---|---|
| IL 371 | Maintenance of Electronics Equipment | Contact Hours | 3 | - | - | 3 |
| | | Credits | 3 | - | - | 3 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal Assessment | | | End Sem Exam | | | | |
| | | IA 1 | IA 2 | Average | | | | | |
| IL 371 | Maintenance of Electronics Equipment | 40 | 40 | 40 | 60 | - | - | -- | 100 |

**Course Objectives**:

1. To demonstrate use of different types of hand tools.
2. To understand testing of different active and passive components mounted on PCB
3. To understand functionality TTL and CMOS digital IC tester.
4. To demonstrate computer assembling, troubleshooting and software installation.
5. To understand/demonstrate concept of circuit diagram of LED/LCD TV, DTH and mobile phone troubleshooting.
6. To understand concept of designing, manufacturing electronic circuit, medical equipment.

**Course Outcomes**:

1. Demonstrate use of different types of hand tools.
2. Understand testing of different active and passive components mounted on PCB.
3. Understand functionality TTL and CMOS digital IC tester.
4. Demonstrate computer assembling, troubleshooting and software installation.
5. Understand/demonstrate concept of circuit diagram of LED/LCD TV, DTH and mobile phone troubleshooting.
6. Understand concept of designing, manufacturing electronic circuit, medical equipment.

**Detailed Lab/Tutorial Description: Students will have to perform six to eight experiments / tutorials in lab from the following list and write journal as a term work.**

| SN | Detailed Lab/Tutorial Description | Hrs. |
|---|---|---|
| 1 | Demonstrate working, use of two instruments in electronics laboratory. | 4 |
| 2 | Test the performance of different passive electronic components (fixed/variable) | 4 |
| 3 | Test the performance of active electronic components like general purpose transistor/FET/MOSFET/SCR/ DIAC/TRIAC with DMM and CRO OR Components Tester | 4 |
| 4 | Verify the functionality of TTL and CMOS Digital IC's using IC tester | 4 |

Acad. Y 23-24

| | | |
|---|---|---|
| 5 | Explore a datasheet of minimum any five electronics components and analog/ Digital IC's. | 4 |
| 6 | Draw the given regulated power supply circuit/ SMPS ( from any television/fridge/ computer system/ laboratory etc) | 4 |
| 7 | Identify basic sections of a personal computer/Laptop | 4 |
| 8 | Demonstrate Assembling of Personal Computer/Laptop | 4 |
| 9 | Troubleshoot the booting process of computer system and install different hardware associated with computer (HDD, LAN Card, Audio System etc) | 4 |
| 10 | Study Installation of Software and Configure Internet | 4 |
| 11 | Explore circuit diagram of LED/LCD TV. | 4 |
| 12 | Demonstrate Installation of DTH system | 4 |
| 13 | Demonstrate installation Solar power system | 4 |
| 14 | Practice steps for mobile troubleshooting | 4 |

In addition, the students will have to submit report in prescribed format and give presentation at the end of semester on any one of the following activity:

| SN | Details of Activity | Hrs. |
|---|---|---|
| 1 | Design and assembling of small electronic project circuit on PCB. Students will learn design of circuit, its simulation, PCB design, PCB manufacturing, soldering of components, troubleshooting of the circuit. | 12 |
| 2 | Visit to medical equipment industry / laboratory | 12 |

**Assessments:**
Internal Assessment: 40 marks
End Semester Examination: 60 marks

**Books/References:**


1. Troubleshooting and Maintenance of Electronics Equipment, Singh K. Sudeep, Katson Book, New Delhi, II edition, Reprint 2014
2. Mobile repairing Books, Manohar Lotia, BPB Publication, New Delhi , latest edition
3. Troubleshooting Electronic Equipment: Includes Repair and Maintenance, Second Edition, Khandpur R. S., Tata McGraw-Hill Education, New Delhi, India, latest edition.
4. Data Books, National semiconductor.
5. Modern Digital Electronics, Fourth edition, R. P. Jain, Tata McGraw-Hill Education, New Delhi, India.
6. Manuals of instruments in electronics laboratories.


Adm. Yr. 23-24

| Course Code | Course Name | Scheme | Theory | Practical | Tutorial | Total |
|---|---|---|---|---|---|---|
| IL 372 | Cooking and Nutrition | Contact Hours | 3 | - | - | 3 |
| | | Credits | 3 | - | - | 3 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal Assessment | | | End Sem Exam | | | | |
| | | IA 1 | IA 2 | Average | | | | | |
| IL 372 | Cooking and Nutrition | 40 | 40 | 40 | 60 | - | - | -- | 100 |

**Course Objectives**: The course is aimed to

1. To understand nutrition and of health problems related to diet and various factors affect diet
2. To various statistical tools required to analyze the experimental data in nutrition and community research
3. Gain information about various food constituents, and changes that occur in them during food processing.
4. To gain food-related knowledge and skills so that they can organise and manage family resources effectively according to the needs and lifestyles of family members
5. To be able to make informed judgements and choices about the use of food available.
6. To create interest in the creative side and enjoyment of food and the skills necessary for food preparation and food preservation. And to be aware of relevant mandatory and other necessary safety and hygiene requirements

**Course Outcomes**: On successful completion of course learner/student will be able to

1. To understand the importance and mechanisms of the food components taking place during food processing,
2. To understand nutrition and of health problems related to diet and various factors affect diet
3. To aware how eating patterns and dietary needs depend on age and social group
4. Ability to assess the effectiveness and validity of claims made by advertisers
5. To enhance aesthetic and social sensitivity to dietary patterns and to develop an interest in the creative aspect and enjoyment of food
6. To develop skills necessary for food preparation and food preservation and knowledge of safety and hygiene requirements

| Module | Detail Content | Hrs. |
|---|---|---|
| 1 | **Nutritional terms**: proteins (high biological and low biological value), carbohydrates (monosaccharide, disaccharide and polysaccharide), fats, vitamins (A, C, D, E, K, B group – thiamin, riboflavin, nicotinic acid and cobalamin), mineral elements (calcium, iron, phosphorous, potassium, sodium, iodide) water Sources and uses of food energy. Sources and functions of dietary fibre. | 3 |
| 2 | **Kitchen equipment & Kitchen planning:** Selection, Use and care of: modern cookers, thermostatic control and automatic time-controlled ovens, microwave ovens, slow electric cook pots, refrigerators and freezers, small kitchen equipment, e.g. knives, pans, small electrical kitchen equipment, e.g. food processors, electric kettles, Advantages and | 4 |

Adm. Y23-24

| | | |
|---|---|---|
| | disadvantages of microwave ovens, Organisation of cooking area and equipment for efficient work., Selection, Use and care of: work surfaces, flooring, walls and wall coverings, lighting, ventilation | |
| 3 | **Meal planning and guidelines:** Factors affecting food requirements, Planning and serving of family meals, Meals for different ages, occupations, cultures and religions, Special needs of: people with food allergies and intolerances, people with medical conditions linked to diet, such as diabetes, convalescents, vegetarians, including vegans and lacto-vegetarians, Meals for special occasions, festivals, packed meals, snacks, beverages, Use of herbs, spices and garnishes, Attractive presentation of food, Terminology describing recommended dietary intakes, e.g. Dietary Reference Value (DRV) and Reference Daily Intake (RDI). | 6 |
| 4 | **Strategic cooking**: Transfer of heat by conduction, convection and radiation. Principles involved in the different methods of cooking, baking, boiling, braising, cooking in a microwave oven, frying, grilling, poaching, pressure cooking, roasting, simmering, steaming, stewing, use of a slow cooker.<br>Reasons for cooking food, Sensory properties of food (flavour, taste, texture), Effect of dry and moist heat on proteins, fats and oils, sugars and starches, and vitamins to include: caramelisation, coagulation dextrinization, enzymic and non-enzymic browning, gelatinisation, rancidity, smoking point, Preparation and cooking of food to preserve nutritive value, Economical use of food, equipment, fuel and labour. | 6 |
| 5 | **Convenience foods and Basic proportions:** Foods partly or totally prepared by a food manufacturer – dehydrated, tinned, frozen, ready-to-eat, Intelligent use of these foods, Advantages and disadvantages, Food additives – types and function, Packaging – types, materials used, Labelling – information found on labels, Importance of maintaining proportions, maintaining proportions for : Bakery products, melting, rubbing-in and whisking methods, Pastries – shortcrust, flaky and rough puff, Sauces – pouring and coating, roux and blended methods, Batters – thin (pouring) and coating, Sweet and savoury yeast products | 5 |
| 6 | **Food preservation & Kitchen safety and first aid**: Food preservation & Kitchen safety and first aid: Reasons for preserving food, Methods of preservation and an understanding of the principles involved: heating – canning, bottling; removal of moisture – dehydrating; reduction in temperature – freezing; chemical preservation – sugar, salt, vinegar; modified atmosphere packaging; irradiation;<br>Awareness of potential danger areas in the kitchen. Safety precautions. First aid for burns and scalds, cuts, electric shock, fainting, shock. | 5 |

**Assessment:**

**Internal Assessment: 40 marks**

1. Consisting of One Compulsory Class Tests of 40 Marks
2. Continuous evaluation: Class Test/ Assignments / Quiz/ Case studies/ Seminar presentation of 40 Marks

**End Semester Examination: 60 marks**

Weightage of each module in the end semester examination will be proportional to the number of respective lecture hours mentioned in the syllabus.

**Books/References:**


1. Fundamentals of Food and Nutrition by Tejmeet Rekhi, Heena Yadav
2. Food Process Engineering And Technology by Akash Pare, B L Mandhyan

| Course Code | Course Name | Scheme | Theory | Practical | Tutorial | Total |
|---|---|---|---|---|---|---|
| IL 373 | Environmental Management | Contact Hours | 3 | - | - | 3 |
| | | Credits | 3 | - | - | 3 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal Assessment | | | End Sem Exam | | | | |
| | | IA 1 | IA 2 | Average | | | | | |
| IL 373 | Environmental Management | 40 | 40 | 40 | 60 | - | - | -- | 100 |

Objectives:

1. To promote the safety, health, and welfare of people and the environment through engineering professionals.
2. To encourage students to be productive and contributing members of the environmental profession as practitioners, entrepreneurs, researchers, or teachers.
3. To develop environmental awareness among students that meet specified engineering needs with consideration of public health, safety, and welfare, as well as global, environmental, and legal factors.

Outcomes: On successful completion of the course learner/student will be able to:

1. Understand core concepts and methods from ecological sciences and their application in environmental problem-solving.
2. Recognize different types of toxic substances and analyze toxicological information
3. Acquire and apply environmental knowledge to the engineering field as needed.
4. 4. Assist industries and projects in obtaining environmental clearance and compliance with other environmental laws.
5. Interpret appropriate environment-related legislation.
6. Develop a thorough understanding of practice and procedure followed by various enforcing agencies/bodies/countries.

| Module | Detail Contents | Hrs. |
|---|---|---|
| 1 | **Fundamentals of Environmental Sciences**<br>Definition, Principles, and Scope of Environmental Science. Structure and composition of the atmosphere, hydrosphere, lithosphere, and biosphere. Concept of Ecology- Ecosystem, Food chain, Food web, Ecological pyramid, Ecological succession, limiting factor, and carrying capacity. Global Environmental Concerns (Global warming, Loss in Bio-diversity, Ozone depletion, E-waste management) and Renewable Energy Resources (Solar Energy, Wind Energy, Hydrothermal Energy, etc.) | 8 |
| 2 | **Environmental Chemistry Toxic chemicals:**<br>Pesticides and their classification and effects. Biochemical aspects of heavy metals (Hg, Cd, Pb, Cr) and metalloids (As, Se), Sewage treatment, Concept of DO, BOD, and COD. Composition of air-chemical | 8 |

Adm. 23-24

| | | |
|---|---|---|
| | processes in the formation of inorganic and organic particulate matter, Thermochemical and photochemical reactions in the atmosphere, Oxygen and Ozone chemistry. Photochemical smog, Air Quality Index | |
| 3 | **Fundamentals of Environmental Management**<br>Concept of Environmental Management, Need & Objective of Environmental Management, Role of Engineers in Environmental Management, Career Opportunities. The need for sustainable development, Sustainable Development Goals | 5 |
| 4 | **Scope of Environmental Management**<br>Role and functions of Government as a planning and regulatory agency. Environment Quality Management and Corporate Environmental Responsibility. Total quality Environmental management: ISO 14000, EMS Certification. Environmental Management System Standards (ISO-14000 series). Environment and Social Management Plan | 7 |
| 5 | **Overview of Environmental Laws in India**<br>Constitutional provisions in India (Articles 48A and 51A). Wildlife Protection Act, 1972 Indian Forest Act, Water (Prevention and Control of Pollution) Act, Air (Prevention and Control of Pollution) Act, Environmental (Protection) Act, 1986, The e-waste (Management) Rules 2016 | 5 |
| 6 | **Environmental Conventions and Agreements**<br>Stockholm Conference on Human Environment 1972, Montreal Protocol, 1987, Earth Summit at Rio de Janeiro, 1992, Agenda-21, Convention on Biodiversity (1992), UNFCCC, Kyoto Protocol, 1997, Copenhagen Summit, Paris Agreement, CITES. | 6 |

**Assessment:**

**Internal Assessment: 40 marks**

1. Consisting of One Compulsory Class Tests of 40 Marks
2. Continuous evaluation: Class Test/ Assignments / Quiz/ Case studies/ Seminar presentation of 40 Marks

**End Semester Examination: 60 marks**

Weightage of each module in the end semester examination will be proportional to the number of respective lecture hours mentioned in the syllabus.

**Books/References:**


1. Environmental Management: Principles and Practice, C J Barrow, Routledge Publishers London, 1999
2. A Handbook of Environmental Management Edited by Jon C. Lovett and David G.Oakwell, Edward Elgar Publishing
3. Environmental Management, V Ramachandra and Vijay Kulkarni, TERI Press
4. Indian Standard Environmental Management Systems — Requirements With Guidance For Use, Bureau of Indian Standards, February 2005
5. Environmental Management: An Indian Perspective, S N Chary and Vinod Vyasulu, Macmillan India, 2000

| Course Code | Course Name | Scheme | Theory | Practical | Tutorial | Total |
|---|---|---|---|---|---|---|
| IL 388 | Quantum Computing and Quantum Technologies – Part 1 | Contact Hours | 3 | - | - | 3 |
| | | Credits | 3 | - | - | 3 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal Assessment | | | End Sem Exam | | | | |
| | | IA 1 | IA 2 | Average | | | | | |
| IL 388 | Quantum Computing and Quantum Technologies – Part 1 | 40 | 40 | 40 | 60 | - | - | -- | 100 |

**Course Objectives:**

1. To provide an overview of the emerging field of Quantum Computing and Technology and make the students familiar with the four verticals of Quantum Technology.
2. To review theoretical core principles of linear algebra and other tools required to understand quantum states, probability and statistics.
3. To understand the basics of computer architecture and digital circuits required for quantum systems.
4. To familiarize students with the concept of qubits and their physical realization.
5. To review basic concepts of quantum mechanics with specific reference to quantum entanglement, superposition and evolution of quantum states with time.
6. To introduce the concept of error correction with reference to quantum systems.

**Course Outcomes:** Students will be able to learn:

1. The basic concept of Quantum Technology and its four verticals.
2. Necessary mathematical tools of linear algebra.
3. Basics of computer architecture and von Neumann architecture, digital circuits.
4. About physical principles of qubits and how they are important for quantum computation.
5. Basic postulates of quantum mechanics, quantum entanglement, time evolution of quantum states.

| Module | Detail Content | Hrs. |
|---|---|---|
| 1 | **Introduction:** National Quantum Mission; Four verticals of Quantum Technologies: Quantum Computing, Quantum Communication, Quantum Sensing and Quantum Materials | 1 |

Adm. Y 23-24

| | | |
|---|---|---|
| 2 | **Review of mathematical tools**: Linear algebra, Probability and Statistics | 5 |
| 3 | **Review of Computer Architecture Basics:** Principles of Computer Design, Basic computer organization and microprocessor, memory management, Relevance to quantum computer architecture | 5 |
| 4 | **Digital Logic and Circuits:** Introduction to digital logic gates, Boolean algebra, Combinational circuits | 5 |
| 5 | **Introduction to Quantum Computing:** Qubits vs classical bits, different types of qubits, Basics of Quantum Algorithms | 10 |
| 6 | **Basics of Quantum Mechanics:** General concepts of superposition, entanglement, and tunneling, Schrödinger equation and Uncertainty Principle, quantum states and time evolution | 13 |

**Assessment:**
Internal Assessment: 40 marks
End Semester Examination: 60 Marks

**Books/References:**


1. Quantum Information Science – Manenti R., Motta M., 1st Edition, Oxford University Press (2023).
2. Elementary Linear Algebra with Applications, Bernard Kolman, David A Hill, Pearson New International Edition, (2013).
3. Elementary Statistics: Picturing the World, Ron Larson, 8th edition, Pearson (2023).
4. Computer system architecture, M. Morris Mano, (3rd ed.). Prentice Hall, Inc. USA.
5. Digital Fundamentals, 11th Edition, Thomas L. Floyd, Pearson Publication.
6. Digital Logic and Computer Design, M. Morris Mano, by Pearson Publication.
7. Quantum computation and quantum information – Nielsen M. A., and Chuang I. L., 10th Anniversary edition, Cambridge University Press (2010).
8. Quantum computing explained, David McMahon, Wiley (2008).
9. Introduction to Quantum Mechanics, Griffiths D. J., 3rd Edition, Cambridge University Press (2024).
10. Principles of Quantum Mechanics, Shankar, R., 2nd edition, Springer (2014).


Admn 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical /Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 391 | Programming Lab II(Web Programming) | 01 | 02 | -- | 01 | 01 | -- | 02 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | 1 | 2 | Average | | | | | |
| EC 391 | Programming Lab II(Web Programming) | - | - | - | - | 25 | -- | 25 | 50 |

**Course Objectives:**

1. To introduce students to the fundamentals of web systems, architectures, and protocols.
2. To develop skills in HTML for structuring web content effectively.
3. To apply CSS for styling, responsive design, and layout management.
4. To enable students to use JavaScript for interactivity, form validation, and DOM manipulation.
5. To familiarize students with modern frontend frameworks, backend development, and database integration.
6. To equip students with skills in deploying, securing, and optimizing web applications.

**Course Outcomes: Upon successful completion of the course students will be able to**

1. Understand and explain web system architecture, internet protocols, and core web technologies.
2. Design and develop structured web pages using HTML and CSS with responsive layouts.
3. Implement interactive features using JavaScript and manage browser/DOM objects.
4. Utilize Bootstrap, Tailwind CSS, and React.js for building modern, responsive user interfaces.
5. Build and connect backend applications using Node.js, Express.js, and MongoDB for dynamic data handling.
6. Deploy secure, optimized web applications using version control, hosting platforms, and best security practices.

Adm. AY 23-24

**DETAILED SYLLABUS:**

| Sr. No. | Module | Detailed Content | Hours |
|---|---|---|---|
| I | HTML | Basic of HTML: Web System architecture-1,2,3 and n tier architecture, URL, domain name system, overview of HTTP and FTP, Cross browser compatibility issues, W3C Validators. Formatting and Fonts, Anchors, images, lists, tables, frames and forms. | 8 |
| II | CSS | Introduction to CSS: Evolution of CSS, Syntax of CSS, Exploring CSS Selectors, Inserting CSS in an HTML Document, Defining Inheritance in CSS, box model, positioning, flexbox, grid, media queries, CSS Grid Layout. | 4 |
| III | JavaScript | Introduction to JavaScript: JavaScript language constructs, Objects in JavaScript- Built in, Browser objects and DOM objects, event handling, form validation and cookies. | 4 |
| IV | Front-End Frameworks & Tools | Bootstrap: Grid System, Components, Utilities, Tailwind CSS: Utility-first styling basics, React.js: Components, Props, State (basics),npm basics and package management | 5 |
| V | Back-End Basics & Database Integration | Basics of Back-End Development,Node.js & npm Overview, Express.js Essentials (Routing, Middleware), Handling GET & POST Requests, Databases: SQL vs NoSQL Basics, CRUD Operations in MongoDB, Simple API Creation with Express, JSON Data Exchange | 2 |
| VI | Deployment, Security & Best Practices | Hosting & Deployment (GitHub Pages, Vercel, Netlify),Domain & DNS Basics, Version Control with Git & GitHub, HTTPS & SSL Certificates, Basic Security (XSS, CSRF prevention), Website Performance Optimization | 3 |

Adm. Y23-24

**Text Books:**

**1.** Responsive Web Design by Example Beginner's Guide by Thoriq Firdaus, PACKT
**2.** Responsive Web Design with HTML5 and CSS3 PACKT
**3.** Web Performance in Action – Jeremy Wagner
4. Learning Web Design – Jennifer Niederst Robbins (covers tools & workflow basics)

**References:**

1. Laravel: Up and Running, By Matt Stauffer O'Reilly Media.
2. Advanced Internet Technologies (includes practicals) ,Deven Shah ,Dreamtech publication

Web Links:

| |
|---|
| HTML<br>● https://www.w3schools.com/html/default.asp<br>● https://developer.mozilla.org/en-US/docs/Learn/HTML |
| CSS<br>● https://www.w3schools.com/css/default.asp<br>● https://developer.mozilla.org/en-US/docs/Learn/CSS |
| JavaScript<br>● https://www.w3schools.com/js/default.asp<br>● https://developer.mozilla.org/en-US/docs/Web/JavaScript |

**Detailed Lab Syllabus:**

**Prerequisite:** Basic programming skills.

**Hardware Requirements:**

PC With following Configuration

1. Intel Core i3/i5/i7 Processor
2. 4 GB RAM
3. 500 GB Hard Disk

**Software Requirements:**

1. Windows or Linux Desktop OS
2. HTML5 compatible web browsers(Chrome, Opera, Firefox, Safari etc)
3. HTML, CSS editors like Dreamweaver, Notepad++ etc.
4. Netbeans or Eclipse IDE
5. XAMPP

**Suggested list of Experiments**

| | Chapter | Suggested Experiments |
|---|---|---|
| I | **Basics of HTML** | 1. Create a personal profile webpage using headings, paragraphs, images, and lists.<br>2. Design a timetable using HTML tables.<br>3. Build a contact form with text fields, radio buttons, checkboxes, and submit/reset buttons.<br>4. Create a multipage website with navigation using anchors. |
| II | **Introduction to CSS** | 1. Apply different CSS selectors to style a webpage.<br>2. Implement a responsive layout using Flexbox.<br>3. Create a 3-column layout using CSS Grid.<br>4. Design a responsive webpage with media queries for mobile and desktop views. |

Adm. y 23-24

| | | |
|---|---|---|
| III | **Introduction to JavaScript** | 1. Create a form with validation for email, phone number, and required fields.<br>2. Use DOM manipulation to dynamically update webpage content.<br>3. Implement an image slider with next/previous buttons.<br>4. Create a simple click counter with event handling. |
| IV | **Front-End Frameworks** | 1. Design a responsive page using Bootstrap Grid and Components.<br>2. Build a simple landing page using Tailwind CSS utility classes.<br>3. Create a basic React component with Props and State.<br>4. Use npm to install and run a frontend package (e.g., Bootstrap via npm). |
| V | **Back-End Developmen t** | 1. Create a basic Express.js server and define routes.<br>2. Handle GET and POST requests with Express.<br>3. Connect Express to MongoDB and perform CRUD operations.<br>4. Build a simple REST API that returns JSON data. |
| VI | **Deployment, Security & Best Practices** | 1. Deploy a static site to GitHub Pages.<br>2. Deploy a Node.js app to Vercel or Netlify.<br>3. Set up a custom domain and enable HTTPS.<br>4. Implement basic XSS and CSRF prevention measures in a sample app. |

**Practical Assessment:** A Practical / Oral exam will be held based on the above syllabus. The final certification and acceptance of TW ensures the satisfactory performance of laboratory work and minimum passing in the TW.

● **Term Work:** The Term work shall consist of at least 08 experiments based on the above list.The term work Journal must include Mini Project based on the content of the syllabus.

**Distribution of Term work marks shall be as below:**

● Term Work Marks - Total 25-Marks: Experiments: 10 Marks, Attendance: 05 Marks, Mini Project: 10 Marks

Adm. y 23-24

# Bachelor of Technology
# In
# Electronics & Computer Science

# (Semester VI)

Adm. Y23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical /Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 309 | Instrumentation & Control System | 03 | -- | -- | 03 | -- | -- | 03 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | 1 | 2 | Average | | | | | |
| EC 309 | Instrumentation & Control System | 40 | 40 | 40 | 60 | -- | --- | ---- | 100 |

**Prerequisite:** Applied Mathematics( Laplace Transform, Ordinary differential equations), Applied Physics, Basic Electrical Engineering

**Course Objectives:**

1. To develop the ability to model control systems and determine their time response and frequency response.
2. To develop the ability to analyze stability of control systems.
3. To develop the ability to understand various types of sensors, transducers and data acquisition systems.

**Course Outcomes: After successful completion of the course students will be able to**

1.Derive the transfer functions for any given control systems.
2.Analyze the performance of control systems based on the time domain and frequency domain specifications.
3. Evaluate the stability of the control systems in time domain and frequency domain.
4.Understand the working principle of sensors and transducers.
5. Explain various parameters of data acquisition systems.
6. Describe instrument communication standards.

**DETAILED THEORY SYLLABUS:**

| Sr. No. | Module | Detailed Content | Hrs. |
|---|---|---|---|
| 1. | **Introduction to Control System** | Examples of control systems; open and closed loop systems; Servomechanism.<br>Mathematical modeling of Electrical & Mechanical Systems; Transfer function model.<br>Block diagram and Signal Flow Graph (SFG) representation of control systems; Block diagram reductions; Mason's gain formula. | **08** |
| 2. | **Time Response Analysis** | Standard test input signals; time response of first and second order systems for standard test inputs; Transient response specification for second order system; Error constants and type of the system.<br>Concept of stability; Routh-Hurwitz Criteria; Relative stability analysis; Root-Locus technique and construction of root-loci. | **08** |
| 3. | **Frequency Response Analysis** | Introduction to frequency response; Frequency response plots: Polar plot and Bode plot; Stability margins in frequency domain,<br>Nyquist stability criterion and stability analysis using Nyquist plot (Numericals not expected). | **06** |

Adm. Y 23-24

| | | | |
|---|---|---|---|
| 4. | **Sensor and Transducers** | Introduction to sensors and transducers. Various types of sensors. Various types of transducers and their principle of operation. Selection criteria of transducers.<br>Displacement and pressure transducers: potentiometers, pressure gauges, Linear variable differential transducer (LVDT), strain gauges.<br>Temperature transducers: working principle, ranges and applications of resistance temperature detectors (RTD), thermocouple and thermistor temperature transducers. | **07** |
| 5. | **Signal conditioning DAS and SCADA** | Introduction to instrumentation systems, data acquisition system (DAS), use of DAS in Intelligent instrumentation system.<br>Data logger, its types and applications.<br>SCADA communication architecture, types, applications, open SCADA protocols. Introduction to Distributed Control system [D.C.S] | **06** |
| 6. | **Telemetry and Instrument communication standards** | Introduction to telemetry, landline telemetry, radio telemetry and types of multiplexing.<br>Instrument interfacing, Current loop, RS232/485, Field bus, Modbus GPIB, USB Protocol, and HART communication Protocol. | **04** |

**Theory Assessments:**

**1. Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.

**2. End Sem Theory Examination:**

- Question paper will consist of 4 questions, each carrying 20 marks.
- Total 3 questions need to be solved.
- Q.1 will be compulsory, based on the entire syllabus.
- Remaining questions will be randomly selected from all the modules.

Weightage of marks should be proportional to the number of hours assigned to each module.

**Books:**


1. K. Ogata, “Modern Control Engineering”, PHI, New Delhi
2. I. J. Nagrath, M. Gopal, “Control System Engineering”, 5th edition, New Age International Publishers
3. A.K. Sawhney, “Electrical & Electronic Measurement & Instrumentation” – DRS. India
4. D. Patranabis, “Principle of Industrial Instrumentation”, Tata McGraw Hill.
5. H.S.Kalsi, “Electronic Instrumentation”-TMH, 2nd Edition.


**References:**


1. Kuo B.C., Automatic Control Systems, Prentice Hall of India Ltd., New Delhi, 1995.
2. Norman S. Nise, “Control System Engineering”, John Wiley and Sons
3. C. S. Rangan, G. R. Sharma and V. S. Mani, ‘Instrumentation Devices and Systems’, Tata McGraw-Hill Publishing Company Ltd.
4. Helfrick& Cooper, “Modern Electronic Instrumentation & Measuring Techniques” – PHI


Appr. AY 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical /Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 310 | Computer Organization & Architecture | 03 | -- | -- | 03 | -- | -- | 03 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | 1 | 2 | Average | | | | | |
| EC 310 | Computer Organization & Architecture | 40 | 40 | 40 | 60 | -- | -- | -- | 100 |

**Course Objectives:**

1. To conceptualize the basics of organizational and architectural issues of a digital computer.
2. To analyze performance issues in processor and memory design of a digital computer.
3. To understand various data transfer techniques in digital computers.
4. To analyze processor performance improvement using instruction level parallelism

**Course Outcomes: Upon successful completion of the course students will be able to**

1. Explain the basic structure of a computer.
2. Do computer arithmetic operations.
3. Elaborate control unit operations.
4. Able to perform the concept of cache mapping techniques.
5. Explain the concept of I/O organization and conceptualize instruction level parallelism.
6. Able to explain the advance computer architectures

**Prerequisite:** Microprocessor and Microcontroller

**DETAILED THEORY SYLLABUS:**

| Sr. No. | Module | Detailed Content | Hrs |
|---|---|---|---|
| 1. | **Introduction to Computer Organization** | 1.1 Introduction to Computer Organization & Architecture, Basic functional blocks of a computer: CPU, memory, input-output subsystems, control unit.<br>1.2 Instruction set architecture of a CPU - registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set.<br>1.3 Evolution of computers, Von Neumann model,<br>1.4 Performance measure of computer architecture. | 06 |

Adm. Y23-24

| | | | |
|---|---|---|---|
| 2. | **Data presentation and Arithmetic algorithm** | 2.1 Signed number representation, fixed and floating point representations, character representation.<br>2.2 Computer arithmetic - integer addition and subtraction, ripple carry adder, carry look-ahead adder.<br>2.3 Multiplication - shift-and-add, Booth multiplier, carry save multiplier.<br>2.4 Division - non-restoring and restoring techniques.<br>2.5 Floating point arithmetic : Addition, Subtraction | 08 |
| 3. | **Processor Organization and Architecture** | 3.1 CPU Architecture, register organization, instruction formats, basic instruction cycle, instruction interpretation and sequencing<br>3.2 Control unit: soft wired (micro-programmed) and hardwired control unit design methods<br>3.3 Introduction to RISC and CISC architectures | 06 |
| 4. | **Memory Organization** | 4.1 Semiconductor memory technologies : SRAM,DRAM. Interleaved and associative memory,<br>4.2 Cache memory concept, mapping techniques, cache coherency, cache performance.<br>4.3 Virtual memory concept, segmentation and paging- | 08 |
| 5. | **Input / Output Organization** | 5.1 IO fundamentals: handshaking, buffering, programmed controlled IO, interrupt driven IO; Interrupt handling mechanism,<br>5.2 Buses: protocols, arbitration, direct memory access (DMA). | 04 |
| 6. | **Fundamentals of Advanced Computer Architecture** | 6.1 Parallel Architecture: Classification of Parallel Systems, Flynn's Taxonomy, Array Processors, Clusters, and NUMA Computers.<br>6.2 Multiprocessor Systems : Structure & interconnection Networks<br>6.3 Multi-Core Computers: Introduction,Organization and Performance. | 07 |

Adm. Y 23-24

**Theory Assessments:**

**1. Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.

**2. End Sem Theory Examination:**

- Question paper will consist of 4 questions, each carrying 20 marks.
- Total 3 questions need to be solved.
- Q.1 will be compulsory, based on the entire syllabus.
- Remaining questions will be randomly selected from all the modules.
- Weightage of marks should be proportional to number of hours assigned to each module.

**Text Books:**

1. Computer Organization and Design, 5th Ed., D. A. Patterson and J. L. Hennessy
2. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, "Computer Organization", Fifth Edition, Tata McGraw-Hill.
3. John P. Hayes, "Computer Architecture and Organization", Third Edition

**References:**


1. William Stallings, “Computer Organization and Architecture: Designing for Performance”, Eighth Edition, Pearson.
2. Govindarajulu, “Computer Architecture and Organization: Design Principles and Applications”, Second Edition, Tata McGraw-Hill.
3. Dr. M. Usha and T. S. Srikanth, “Computer System Architecture and Organization”, First Edition, Wiley-India.
4. Ramesh Gaonkar, “Microprocessor Architecture, Programming and Applications with the 8085”, Fifth Edition, Penram.
5. Microprocessor Architecture, Jean Loup Baer.


Adm. Y 23-24

| Course Code | Course Name | Theory (Hrs) | Practical (Hrs) | Tutorial (Hrs) | Theory (Credits) | Practical/Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 311 | Software Testing & Quality Assurance | 03 | 02 | -- | 03 | – | -- | 03 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | Test1 | Test 2 | Avg. of 2 Tests | | | | | |
| EC 311 | Software Testing and Quality Assurance | 40 | 40 | 40 | 60 | - | -- | - | 100 |

**Course Objectives:**

1. To provide students with knowledge in Software Testing techniques.
2. To provide knowledge of Black Box and White Box testing techniques.
3. To provide skills to design test case plans for testing software.
4. To prepare test plans and schedules for testing projects.
5. To understand how testing methods can be used in a specialized environment.
6. To understand how testing methods can be used as an effective tool in providing quality assurance concerning software.

**Course Outcomes: Upon successful completion students will be able to**

1. Investigate the reason for bugs and analyze the principles in software testing to prevent and remove bugs.
2. Understand various software testing methods and strategies.
3. Manage the testing process and testing metrics.
4. Understand fundamental concepts of software automation and use automation tools.
5. Apply the software testing techniques in the real time environment.
6. Use practical knowledge of a variety of ways to test software and quality attributes.

**Prerequisite:** Programming Language (C++, Java), Software Engineering.

Adm. Y 23-24

**DETAILED THEORY SYLLABUS:**

| Sr. No. | Module | Detailed Content | Hours |
|---|---|---|---|
| 1 | **Testing Methodology** | Introduction, Goals of Software Testing, Software Testing Definitions, Model for Software Testing, Effective Software Testing vs Exhaustive Software Testing, Software Failure Case Studies, Software Testing Terminology, Software Testing Life Cycle (STLC), Software Testing methodology, Verification and Validation, Verification requirements, Verification of high level design, Verification of low level design, validation. | 07 |
| 2 | **Testing Techniques** | Dynamic Testing: Black Box Testing: Boundary Value Analysis, Equivalence Class Testing, State Table Based testing, Cause-Effect Graphing Based Testing, Error Guessing. White Box Testing Techniques: need, Logic Coverage Criteria, Basis Path Testing, Graph Matrices, Loop Testing, Data Flow testing, Mutation testing. Static Testing. Validation Activities: Unit validation, Integration, Function, System, Acceptance Testing. Regression Testing: Progressive vs. Regressive, Regression Testing, Regression Testability, Objectives of Regression Testing, Regression Testing Types, Define Problem, Regression Testing Techniques. | 09 |
| 3 | **Managing the Test Process** | Test Management: test organization, structure and of testing group, test planning, detailed test design and test Specification. Software Metrics: need, definition and Classification of software matrices. Testing Metrics for Monitoring and Controlling the Testing Process: attributes and corresponding metrics, estimation model for testing effort, architectural design, information flow matrix used for testing, function point and test point analysis. Efficient Test Suite Management: minimizing the test suite and its benefits, test suite minimization problem, test suite prioritization its type , techniques and measuring effectiveness. | 08 |
| 4 | **Test Automation** | Automation and Testing Tools: need, categorization, selection and cost in testing tool, guidelines for testing tools. Study of testing tools: JIRA, Bugzilla, TestDirector and IBM Rational Functional Tester, Selenium etc. | 05 |
| 5 | **Testing for specialized environment** | Agile Testing, Agile Testing Life Cycle, Testing in Scrum phases, Challenges in Agile Testing Testing Web based Systems: Web based system, web technology evaluation, traditional software and web based software, challenges in testing for web based software, testing web based testing Self-learning Topics: Study the recent technical papers on software testing for upcoming technologies (Mobile, Cloud, Blockchain, IoT) | 05 |

Adm. w.e.f. 2024

| | | | |
|---|---|---|---|
| 6 | **Quality Management** | Software Quality Management, McCall's quality factors and Criteria, ISO9000:2000, SIX sigma, Software quality management | 05 |

**Theory Assessments:**

**1. Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.

**2. End Sem Theory Examination:**

- Question paper will consist of 5 questions, each carrying 20 marks.
- Total 3 questions need to be solved.
- Q.1 will be compulsory, based on the entire syllabus.
- Remaining questions will be randomly selected from all the modules.
- Weightage of marks should be proportional to number of hours assigned to each module.

**Text Books:**


1. Software Testing Principles and Practices Naresh Chauhan Oxford Higher Education
2. Software Testing and quality assurance theory and practice by Kshirasagar Naik, Priyadarshi Tripathy , Wiley Publication.


**References:**


1. Effective Methods for Software Testing , third edition by Willam E. Perry, Wiley Publication
2. Software Testing Concepts and Tools by Nageswara Rao Pusuluri , Dreamtech press


Online References:

1. www.swayam.gov.in
2. www.coursera.org
3. http://onlinelibrary.wiley.com/journal/10.1002/(ISSN)1099 -1689
4. https://onlinecourses.nptel.ac.in/noc17_cs32/preview
5. https://www.youtube.com/channel/UC8w8_H_1uDfi2ftQx7a64uQ

Adm. Y 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical /Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 312 | Foundations of Robotics | 03 | 02 | -- | 03 | 01 | -- | 04 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | 1 | 2 | Avg. | | | | | |
| EC 312 | Foundations of Robotics | 40 | 40 | 40 | 60 | 25 | 25 | – | 150 |

**Course Objectives:**

1. To provide students with a foundational understanding of robotics concepts, including history, evolution, and applications.
2. To familiarize students with the basics of embedded systems, microcontrollers, sensors, and actuators used in robotics.
3. To introduce students to robot kinematics, dynamics, and programming for embedded systems.
4. To develop students' skills in interfacing sensors and actuators with microcontrollers.
5. Understanding and Exploring Robotic Vision Fundamentals
6. To introduce students to Robot Operating Systems (ROS) and its applications in robotics.

**Course Outcomes: Upon successful completion of the course students will be able to**

1. Comprehend the historical development and current applications of robotics technology.
2. Apply proficiency in programming microcontrollers using C/C++ for robotics applications.
3. Analyze simple robotic systems by applying the principles of robot kinematics and dynamics.
4. Implement basic control algorithms by interfacing various sensors and actuators with microcontrollers.
5. Create vision systems tailored for robotic applications, considering factors such as sensor selection, calibration, and system integration.
6. Develop simple robotic applications and simulate robot behavior using ROS.

**Prerequisite:** Digital Electronics, Microcontroller and Microprocessor, Programming language.

**DETAILED THEORY SYLLABUS:**

| Sr. No. | Module | Detailed Content | Hrs |
|---|---|---|---|
| **1** | **Introduction to Robotics** | 1.1 Definition and scope of robotics,<br>1.2 Brief history of robotics,<br>1.3 Type and Classification of Robots,<br>1.4 Asimov‘s laws of robotics<br>1.5 Robot Anatomy, and its Working,<br>1.6 Robotic System Architecture. | 06 |
| **2** | **Sensing and Perception** | 2.1 Types of sensors and their principles Position sensors, Range sensors [LiDAR, UltraSonic sensors], Proximity sensing; Inertial Measurement Unit (IMU) sensor. | 06 |
| **3** | **Actuators and Motion** | 3.1 Servo Motors 3.2 Grippers: Principles of Gripper Design, actuation methods, and Applications 3.3 Motor Drivers 3.4 Comparison of Different Drives in Robotics, 3.5 Selection Parameters of drive 3.6 Microactuators, 3.7 Determination of HP of motor, | 07 |
| **4.** | **Embedded systems and programming** | 4.1 Introduction to embedded systems, Design metrics,<br>4.2 Introduction to embedded hardware platforms – STM Board & programming model<br>4.3 Programming and interfacing of sensors and actuators<br>4.4 Wired and wireless communication systems – CAN, Modbus, Bluetooth(BLE), Wi-Fi (802.11) | 07 |
| **5.** | **Introduction to Robot Operating Systems (ROS)** | 5.1 Overview of ROS Architecture: nodes, topics, messages, services, and the ROS Master.<br>5.2 ROS Tools: roscore, roslaunch, rviz, rqt, and rosbag for system development, visualization, debugging, and data logging.<br>5.3 Exploring ROS Packages,<br>5.4 ROS Communication Mechanisms: publishing and subscribing to topics, calling and providing services, and sharing data using message types<br>5.5 ROS Configuration and Launch Files<br>5.6 Robot Control and Navigation: ROS control, robot modeling, simulation, motion planning, and path following. | 07 |
| **6.** | **ROS integration and case studies** | 6.1 Integration with Sensor Systems: cameras, LiDAR, IMUs, and depth sensors<br>6.2 ROS Middleware and Ecosystem: ROS libraries, frameworks, and community resources for robotics development.<br>6.3 Autonomous Vehicles<br>6.4 Agricultural Robotics | 06 |

Asm. 2023-24

**DETAILED LAB SYLLABUS:**

**Hardware Requirements:** STM microcontroller

**Software Requirements:** Matlab, Keil, ROS

| Sr. No. | Detailed Lab Description |
|---|---|
| 1 | Study of Embedded C programming on STM32F767ZI MCU Development Board |
| 2 | Sensor Interfacing and Data Acquisition with STM32F767ZI MCU Development Board |
| 3 | PWM based Actuator Control using STM32F767ZI MCU Development Board |
| 4 | Introduction to ROS and Basic Commands |
| 5 | Basic simulations of robotic systems, including robot models, world environments on Gazebo simulation environment integrated with ROS. |
| 6 | Interface sensors with ROS for data acquisition (sensors such as cameras, or ultrasonic sensors) |
| 7 | Interface sensors with ROS for data acquisition (LiDAR) |
| **8** | Collecting sensor data, processing it with ROS nodes, and controlling actuators based on sensor feedback (controlling actuators such as motors) |
| 9 | Collecting sensor data, processing it with ROS nodes, and controlling actuators based on sensor feedback (controlling actuators such as grippers) |
| 10 | Mini Project |

**Theory Assessments:**

1. **Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.
2. **End Sem Theory Examination:**
   - Question paper will consist of 4 questions, each carrying 20 marks.
   - Total 3 questions need to be solved.
   - Q.1 will be compulsory, based on the entire syllabus.
   - Remaining questions will be randomly selected from all the modules.
   - Weightage of marks should be proportional to number of hours assigned to each module.

**Lab Assessments:**

**1.Term work Assessment:**

At least 07 Experiments and 3 Assignments based on the entire syllabus and **one course mini project/seminar** must be submitted by a maximum batch of 2 to 3 students. Term work assessment must be based on the overall performance of the student with every experiment and Course-project is graded from time to time.

**2.Oral/Viva Assessment:** Based on the above contents and entire syllabus.

**Text Books:**

1. Saeed B. Niku, "Introduction to Robotics: Analysis, Systems,Applications",Pearson Education Inc.,New DELHI, 2006

Adm. Y 23-24

2. "Programming Robots with ROS: A Practical Introduction to the Robot Operating System" by Morgan Quigley, Brian Gerkey, and William D. Smart, Publisher: O'Reilly Media
3. Ganesh S. Hedge A Text book on "Industrial Robotics", Laxmi Publications Pvt. Ltd.,New Delhi.
4. S.R. Deb & Sankha Deb, "Robotics Technology and FlexibleAutomation Robot", Tata McGrawHill, 2010.
5. Sriram V Iyer, Pankaj Gupta, “Embedded Real Time Systems Programming”, Tata Mc Graw Hill,2004.

**References:**

1. "Robotics: Everything You Need to Know About Robotics from Beginner to Expert" by Peter Mckinnon.
2. "Introduction to Robotics: Mechanics and Control" by John J. Craig.
3. K.V.K.K.Prasad, “Embedded Real-Time Systems: Concepts, Design & Programming”, DreamTech Press, 2005
4. M.P. Groover "Industrial Robotics: Technology, Programming and Applications" Tata Mc Graw Hill Co,2001

Adm. Y 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical/ Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 313 | Cryptography and System Security | 03 | 02 | -- | 03 | 01 | -- | 04 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | 1 | 2 | Average | | | | | |
| EC 313 | Cryptography and System Security | 40 | 40 | 40 | 60 | 25 | -- | 25 | 150 |

**Course Objectives:**

1. To introduce the concepts of modular arithmetic and number theory and their application in Classical Encryption techniques.
2. To explore the working principles and utilities of various cryptographic algorithms including Secret Key Cryptography and Public Key Cryptography.
3. To explore various hashing and Message Digest Algorithms to achieve Confidentiality and Integrity.
4. To explore the design issues and working principles of various authentication protocols, PKI standards and different digital signature algorithms to achieve authentication.
5. To explore various secure communication standards including Kerberos, IPsec, and SSL/TLS and email.
6. To develop the ability to use existing cryptographic utilities to build programs for secure communication.

**Course Outcomes: Upon successful completion of the course students will be able to**

1. Understand system security goals and concepts, classical encryption techniques and acquire fundamental knowledge on the concepts of modular arithmetic and number theory.
2. Understand, compare and apply different encryption and decryption techniques to solve problems related to confidentiality and authentication
3. Apply the knowledge of cryptographic checksums and evaluate the performance of different message digest algorithms for verifying the integrity of varying message sizes.
4. Apply different digital signature algorithms to achieve authentication and design secure applications
5. Understand network security basics, analyze different attacks on networks and evaluate the performance of firewalls and security protocols like SSL, IPSec, and PGP.
6. Analyze and apply system security concepts to recognize malicious code.

**Prerequisite:**Computer Networks, ISO OSI Layered Protocols, TCP/IP protocol suite.

Acad. Yr. 23-24

**DETAILED THEORY SYLLABUS:**

| Sr. No. | Module | Detailed Content | Hours |
|---|---|---|---|
| 1. | **Introduction and Number Theory** | Security Goals, Attacks, Services and Mechanisms, Techniques. The OSI security architecture, Network Security Model, Classical Encryption Techniques, Symmetric cipher model, mono-alphabetic and poly-alphabetic substitution techniques: Vigenere cipher, playfair cipher, Hill cipher, transposition techniques: keyed and keyless transposition ciphers<br><br>Modular Arithmetic and Number Theory:- Euclid‘s algorithm, Prime numbers, Fermat‘s & Euler‘s theorem - Testing for primality, | 09 |
| 2. | **Symmetric and Asymmetric key Cryptography and key Management** | Block cipher principles, block cipher modes of operation, DES, Double DES, Triple DES, Advanced Encryption Standard (AES), Stream Ciphers: RC4 algorithm<br><br>Public key cryptography: Principles of public key cryptosystems-The RSA algorithm, The knapsack algorithm,Symmetric Key Distribution techniques: KDC, Needham-schroeder protocol. Kerberos: Kerberos Authentication protocol, Diffie Hellman Key exchange algorithm. Public key Distribution: Digital Certificate: X.509, PKI | 08 |
| 3. | **Hashes, Message Digests and Digital Certificates** | Cryptographic hash functions, Hash function requirements, Hash function uses, MD5, SHA-1, MAC, HMAC, CMAC | 04 |
| 4. | **Authentication Protocols & Digital signature schemes** | Authentication Requirement and Functions, Types of Authentication, User Authentication and Entity Authentication: Password Based, Challenge Response Based Authentication<br><br>Importance of Digital Signature, Attacks on Digital Signature, Digital Signature Schemes – RSA, | 05 |
| 5. | **Network Security and Applications** | Network Security Basics,TCP/IP Vulnerabilities (Layer-wise): Application layer: HTTP, DHCP Transport layer: TCP syn flood, Port Scanning, Network layer: IP Spoofing, Packet sniffing, ARP Spoofing,DOS: Classic DOS attacks: Ping flood, ICMP flood, UDP flood, Distributed DOS, Defenses against DOS attacks<br><br>Internet Security Protocols: SSL, IPSEC, Secure Email: PGP, Network Security: Firewall, IDS | 09 |
| 6. | **System Security** | Software Vulnerabilities: Buffer Overflow,Malwares: Viruses, Worms, Trojans, SQL injection, cross-site scripting | 04 |

Adm. Y 2024

**DETAILED LAB SYLLABUS:**

**Hardware Requirements: PC With following Configuration**

1. Intel Core i3/i5/i7 Processor
2. 4 GB RAM
3. 500 GB Hard Disk

**Software Requirements:**

1. Windows / Linux Desktop OS / Kali Linux
2. wireshark
3. ARPWATCH
4. Cppcheck
5. Hping, hping3

| Sr. No. | Detailed Lab/Tutorial Description |
|---|---|
| 1 | Design and Implementation of a product cipher using Substitution and Transposition ciphers |
| 2 | 1. Implementation and analysis of RSA cryptosystem and Digital signature scheme using RSA.<br>2. Implementation of Diffie Hellman Key exchange algorithm.<br>3. For varying message sizes, test integrity of message using MD-5, SHA-1, and analyse the performance of the two protocols. |
| 3 | Study the use of network reconnaissance tools like WHOIS, dig, traceroute, nslookup to gather information about networks and domain registrars. |
| 4 | Study of packet sniffer tools :wireshark, :<br>1. Download and install wireshark and capture icmp, tcp, and http packets in promiscuous mode.<br>2. Explore how the packets can be traced based on different filters.<br>3. Download and install nmap. Use it with different options to scan open ports, perform OS fingerprinting, do a ping scan, tcp port scan, udp port scan, xmas scan etc.<br>4. Detect ARP spoofing using nmap and/or open source tool ARPWATCH and wireshark. |
| 5 | 1. Setting up personal Firewall using iptables.<br>2. Explore the GPG tool of linux to implement email security.<br>3. Set up Snort and study the logs. |
| 6 | 1. Simulate buffer overflow attack using Ollydbg, Splint, Cppcheck etc.<br>2. Simulate DOS attack using Hping, hping3. |

**Theory Assessments:**

**1. Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.

**2. End Sem Theory Examination:**

- Question paper will consist of 5 questions, each carrying 20 marks.
- Total 3 questions need to be solved.
- Q.1 will be compulsory, based on the entire syllabus.
- Remaining questions will be randomly selected from all the modules.

Adm. Y 23-24

- Weightage of marks should be proportional to number of hours assigned to each module.

**Lab Assessment:**

**1. Term work Assessment:**
The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.

**2. Oral/Viva Assessment:** Practical and Oral exam will be based on the entire syllabus.

**Text Books:**


1. William Stallings, Cryptography and Network Security, Principles and Practice, 6th Edition, Pearson Education, March 2013
2. Behrouz A. Ferouzan, ―Cryptography & Network Security‖, Tata Mc Graw Hill
3. Bernard Menezes, ―Cryptography & Network Security‖, Cengage Learning.
4. Network Security Bible, Eric Cole, Second Edition, Wiley.


**References:**


1. Applied Cryptography, Protocols Algorithms and Source Code in C, Bruce Schneier, Wiley.
2. Cryptography and Network Security, Atul Kahate, Tata Mc Graw Hill


.

Adm. Y 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical /Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 314 | Mobile & Distributed Computing | 03 | 02 | -- | 03 | 01 | -- | 04 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | 1 | 2 | Avg. | | | | | |
| EC 314 | Mobile & Distributed Computing | 40 | 40 | 40 | 60 | 25 | -- | 25 | 150 |

**Course Objectives:**

1. To introduce the basic concepts and principles in mobile networking infrastructures & Mobility Management computing.
2. To provide an opportunity for students to understand the mobile network services.
3. To provide an opportunity for students to understand the advanced network services in mobile computing.
4. To introduce basic concepts, goals, issues of distributed systems.
5. To understand the concept of Inter process communications, Message oriented communication, stream oriented communications.
6. To provide master skills to measure the performance of distributed synchronization algorithms.

**Course Outcomes: Upon successful completion of the course students will be able to**

1. Identify an opportunity for students to understand the mobile network services.
2. Describe an opportunity for students to understand the mobile network services
3. Describe an opportunity for students to understand the advanced network services in mobile computing.
4. Understand the basic elements and concepts related to distributed systems and illustrate the middleware technologies that supports distributed applications such as RPC, RMI and object based middleware.
5. Understand the concepts of resource and process management.
6. Analyse various techniques used for clock synchronization, election of coordinators and distributed mutual exclusion.

**Prerequisite:** Computer Networks

**DETAILED THEORY SYLLABUS:**

| Sr. No. | Module | Detailed Content | Hrs |
|---|---|---|---|
| 1. | **Mobile Networking Infrastructures &** | Overview of the Internet Protocol (IP) and its importance in networking.<br>Different versions, format and structure of IP addresses: IPv4 and IPv6.<br>Public vs. private IP addresses. | 04 |

Appl. AY 23-24

| | | | |
|---|---|---|---|
| | **Mobility Management** | Sub netting and CIDR notation.<br>Mobility Management : Introduction, IP Mobility, Optimization, IPv6Macro Mobility : MIPv6, Micro Mobility: Cellular IP | |
| 2. | **Mobile Network Services** | GSM Mobile services, System Architecture, Protocols ,<br>Handover GPRS system and protocol architecture, UMTS core network.<br>Wireless Local Area Networks : Introduction, Infrastructure and ad-hoc network.<br>Dynamic Host Configuration Protocol (DHCP).<br>Introducing Remote Administration, Enable Remote Desktop, Access Remote Desktop. Defining Name Resolution Techniques, Defining DNS | 10 |
| 3. | **Advanced Network Services in mobile computing** | LTE System Overview,Voice over LTE (VoLTE): Introduction, system overview: Frequency bands and spectrum flexibility, network structure, protocol structure, Physical layer: Frames, slots, and symbols, modulation, coding, multiple-antenna techniques, Logical and Physical Channels: Mapping of data onto (logical) sub-channels,<br>Establishing a connection, Physical layer retransmissions and reliability, Power control, and handover. | 06 |
| 4. | **Distributed Computing Systems** | Characterization of Distributed Systems: Types of distributed systems (Difference between tightly coupled and loosely<br>coupled multiprocessor systems), Issues (Transparency, Performance Transparency, Scaling Transparency, Reliability, Fault Avoidance, Fault Tolerance, Fault Detection and Recovery, Flexibility, Performance, Scalability), Goals,<br>and Distributed Computing System Models. Distributed Share Memory. | 06 |
| 5. | **Distributed Computing Communication** | Introduction to message passing, Remote communication:<br>Remote Procedure Call (RPC):<br>Transparency of RPC, Implementing RPC mechanism, Stub Generation, RPC Messages, Marshaling Arguments and Results, Server Management.<br>Remote Object Invocation (ROI):<br>Remote Method Invocation (RMI):<br>RMI Architecture, Four Layered Operation, RMI Components. | 07 |
| 6. | **Synchronization** | Clock Synchronization, Physical clock synchronization algorithm, Logical (lamport) Clock, Election Algorithms. | 04 |

**DETAILED LAB SYLLABUS:**

**Software Requirements:** J2ME, Android Studio, NS2, MATLAB

| Sr. No. | Detailed Lab Description |
|---|---|
| 1 | Study of NS2 installation and mobile node creation in NS2 |
| 2 | Implementation of packet transfer using TCP in mobile nodes |
| 3 | To implement Logical Clock Synchronization algorithm (Lamport clock) |
| 4 | To implement an election algorithm |
| 5 | To implement OBEX protocol using bluetooth |
| 6 | Develop an application that uses GUI components in Android |
| 7 | Write an application that draws basic graphical primitives on the screen in Android |
| 8 | To implement a mutual exclusion algorithm |
| 9 | MINI PROJECT: Develop an android application for social needs |

**Theory Assessments:**

1. **Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.
2. **End Sem Theory Examination:**

- Question paper will consist of 4 questions, each carrying 20 marks.
- Total 3 questions need to be solved.
- Q.1 will be compulsory, based on the entire syllabus.
- Remaining questions will be randomly selected from all the modules.

Weightage of marks should be proportional to number of hours assigned to each module.

**Lab Assessments:**

**1.Term work Assessment:**

At least 08 Experiments and 2 Assignments based on the entire syllabus and **one mini project** must be submitted by a maximum batch of 3 to 4 students. Term work assessment must be based on the overall performance of the student with every experiment and mini project is graded from time to time.The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.

**2.Oral/Viva Assessment:** Based on the above contents and entire syllabus.

**Text Books:**


1. Jochen Schilller,‖Mobile Communication ―, Addision wisely,Pearson Education, 2nd Edition.
2. Wireless Communications & Networks,‖ By William Stallings, Second Edition, Pearson Education .
3. Raj Kamal, Mobile Computing, 2/e , Oxford University Press-New Delhi


**References:**

Adm. Y 23-24

1. LTE Self-Organizing Networks (SON): Network Management Automation for Operational
   Efficiency, Seppo Hamalainen, Henning Sanneck , Cinzia Sartori, Wiley publications .
2. Christopher Cox, ―An Introduction to LTE: LTE, LTE-Advanced, SAE and 4G Mobile Communications,‖ Wiley publications .
3. Mobility Protocols and Handover Optimization: Design, Evaluation and Application By Ashutosh Dutta, Henning Schulzrinne, IEEE Press, Wiley Publication.
4. Michael Gregg, ―Build your own security lab,‖ Wiley India edition .
5. Emerging Wireless Technologies and the Future Mobile Internet, Dipankar Raychaudhuri, Mario Gerla, Cambridge.
6. Andreas F.Molisch, ―Wireless Communications,‖ Second Edition, Wiley Publications.

Adm. Y 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical /Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 315 | Integrated Circuit Technology | 03 | 02 | -- | 03 | 01 | -- | 04 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | Test1 | Test 2 | Avg. of 2 Tests | | | | | |
| EC 315 | Integrated Circuit Technology | 40 | 40 | 40 | 60 | 25 | -- | 25 | 150 |

**Course Objectives:**

1. To provide knowledge of Wafer preparation and fabrication for VLSI Technology
2. To provide knowledge of IC fabrication processes and advanced IC technologies.
3. To provide knowledge of IC fabrication processes and design rules.
4. To disseminate knowledge about novel semiconductor measurement.
5. To provide knowledge about different VLSI Technology.
6. To disseminate knowledge about novel VLSI devices and materials.

**Course Outcomes: Upon successful completion of the course students will be able to**

1. Analyze and demonstrate a clear understanding of various MOS fabrication processes & CMOS fabrication flow.
2. Analyze and design layout of MOS based Circuits.
3. Demonstrate a clear understanding of Semiconductor Measurements & Testing.
4. Analyze SOI and GaAs technology.
5. Develop different fabrication process.
6. Understand advanced technologies, Novel Devices and materials in Modern VLSI Technology.

**Prerequisite:** Electronic Devices and Circuits I, Digital Circuit Design, VLSI Design

**DETAILED THEORY SYLLABUS:**

| Sr. No. | Module | Detailed Content | Hours |
|---|---|---|---|
| 1. | **Crystal Growth, Wafer preparation and fabrication for VLSI Technology** | Semiconductor Manufacturing: Semiconductor technology trend, Clean rooms, Wafer cleaning and Gettering. Semiconductor Substrate: Crystal structure, Crystal defects, Czochralski growth, Float Zone growth, Bridgman growth of GaAs, Wafer Preparation and specifications | 08 |
| 2. | **Fabrication Processes Part 1** | Epitaxy: Classification, Molecular Beam Epitaxy Silicon Oxidation: Thermal oxidation process, Kinetics of growth, Properties of Silicon Dioxide, Oxide Quality. | 07 |

Acad. Yr. 23-24

| | | | |
|---|---|---|---|
| | | Device Isolation: LOCOS, Shallow Trench Isolation (STI).<br>Deposition: Physical Vapor Deposition-Evaporation and Sputtering,<br>Chemical Vapor Deposition: APCVD, LPCVD,PECVD<br>Diffusion: Nature of diffusion, Diffusion in a concentration gradient, diffusion Equation, diffusion systems, problems in diffusion.<br>Ion Implantation: Penetration range-Nuclear& Electronic stopping and Range, implantation damage, Annealing-Rapid thermal annealing, ion implantation systems. | |
| 3. | **Fabrication Process Part 2** | Etching & Lithography:<br>Etching: Basic concepts and Classification<br>Lithography: Introduction to Lithography process, Types of Photoresist,<br>Types of Lithography: Electron beam, Ion beam and X-ray lithography.<br>Metallization and Contacts: Introduction to Metallization, Schottky contacts and Ohmic contacts.<br>CMOS Process Flow: N well, P-well and Twin tub, CMOS Latch Up<br>Design rules, Layout of MOS based circuits (gates and combinational logic), Buried and Butting Contact. | 07 |
| 4. | **Measurement and Testing** | Semiconductor Measurements: Conductivity type, Resistivity, Hall Effect Measurements, Drift Mobility.<br>Testing: Technology trends affecting testing, VLSI testing process and test<br>equipment, test economics and product quality. | 06 |
| 5. | **VLSI Technologies** | SOI Technology: SOI fabrication using SIMOX, Bonded SOI and Smart Cut ,PD ,SOI and FD SOI Device structure and their features.<br>Advanced Technologies: low κ and high κ, BiCMOS, HκMG Stack, Strained Silicon.<br>GaAs Technologies: MESFET Technology, MMIC technologies, MODFET | 06 |
| 6. | **Novel Devices and Materials** | Multigate Devices:Various multigate device configurations-double gate, triple gate (FinFET) and Gate All Around (Nanowire).<br>Nanowire: Concept, VLS method of fabrication, Nanowire FET, Types: Horizontal and Vertical Nanowires, III-V compound Materials in Nanowires.<br>2-D Materials and FET:Graphene& CNT FET, MOS2 and Black Phosphorous. | 05 |

**DETAILED LAB SYLLABUS:**

**Software Requirements:** NANOHUB, MICROWIND

Acad. Yr. 23-24

| Sr. No. | Detailed Lab Description |
|---|---|
| 1 | To study the CZ process for Silicon Crystallization. |
| 2 | Implement NMOS inverter with resistive load using NANOHUB and study its characteristics. |
| 3 | Various effects of Temperature on Thermal Oxidation using NANOHUB. |
| 4 | Design of CMOS Inverter using Microwind. |
| 5 | Design of CMOS NAND using Microwind. |
| 6 | Design of CMOS NOR using Microwind. |
| 7 | Design of CMOS EXOR using Microwind. |
| 8 | To implement the given function Y=A+BC using Microwind. |
| 9 | Design of 6T SRAM using Microwind. |
| 10 | Case Study IEEE paper. |

**Theory Assessments:**

**1. Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.

**2. End Sem Theory Examination:**

- Question paper will consist of 4 questions, each carrying 20 marks.
- Total 3 questions need to be solved.
- Q.1 will be compulsory, based on the entire syllabus.
- Remaining questions will be randomly selected from all the modules.
- Weightage of marks should be proportional to number of hours assigned to each module.

**Lab Assessments:**

**1.Term work Assessment:**

- Term work should consist of 10 experiments.
- Journal must include at least 2 assignments
- Mini Project to be performed

Total 25 Marks (Experiments: 10-marks, Attendance Theory & Practical: 05-marks, Assignments: 05-marks, Mini Project: 5-marks)

**2.Oral/Viva Assessment**:

Based on the above contents and entire syllabus.

**Text Books:**

1. James D. Plummer, Michael D. Deal and Peter B. Griffin, “Silicon VLSI Technology”, Pearson, Indian Edition.

Adm. Y 23-24

2. Stephen A. Campbell, “The Science and Engineering of Microelectronic Fabrication”, Oxford University Press, 2nd Edition.
3. Sorab K. Gandhi, “VLSI Fabrication Principles”, Wiley, Student Edition.
4. G. S. May and S. M. Sze, “Fundamentals of Semiconductor Fabrication”, Wiley, First Edition.
5. Kerry Bernstein and N. J. Rohrer, “SOI Circuit Design Concepts”, Kluwer Academic Publishers, 1st edition.

**References:**

1. Jean-Pierre Colinge, “FinFETs and Other Multigate Transistors”, Springer, 1st edition
2. M. S. Tyagi, “Introduction to Semiconductor Materials and Devices”, John Wiley and Sons,1st edition.
3. James E. Morris and KrzysztolIniewski, “Nanoelectronic Device ApplicationsHandbook”, CRC Press.
4. Glenn R. Blackwell, “The electronic packaging”, CRC Press.
5. Michael L. Bushnell and Vishwani D. Agrawal, “Essentials of Electronic Testing for digital, memory and mixed-signal VLSI circuits”, Springer.
6. G.S.May and S. M. Sze, “Fundamentals of Semiconductor Fabrication”, Wiley, First Edition.

Adm. Y 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical /Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 316 | Machine Learning | 03 | 02 | -- | 03 | 01 | -- | 04 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | 1 | 2 | Average | | | | | |
| EC 316 | Machine Learning | 40 | 40 | 40 | 60 | 25 | -- | 25 | 150 |

**Course Objectives:**

1. To introduce the basic concepts and techniques of Machine Learning.
2. To acquire in depth understanding of various supervised and unsupervised algorithms
3. To be able to apply various ensemble techniques for combining ML models.
4. To demonstrate dimensionality reduction techniques.

**Course Outcomes: Upon successful completion of the course students will be able to:**

1. Acquire fundamental knowledge of developing machine learning models.
2. Comprehend regression, classification that are used in machine learning.
3. Demonstrate ensemble techniques to combine predictions from different models.
4. Identify and apply classification models to real world problems.
5. Apply different clustering methods that are used in machine learning.
6. Demonstrate the dimensionality reduction techniques.

**Prerequisite:** Data Structures, Algorithms, Linear algebra, multivariate calculus, and probability theory

**DETAILED THEORY SYLLABUS:**

| Sr. No. | Module | Detailed Content | Hours |
|---|---|---|---|
| 1. | **Introduction to Machine Learning** | 1.1: Machine Learning, Types of Machine Learning, Issues in Machine Learning, Application of Machine Learning, Steps in developing a Machine Learning Application.<br>1.2: Training Error, Generalization error, Overfitting, Underfitting, BiasVariance trade-off. | 04 |

Adm. Y23-24

| | | | |
|---|---|---|---|
| 2. | **Learning with Regression and Trees** | 2.1: Learning with Regression: Linear Regression, Multivariate Linear Regression, Logistic Regression.<br>2.2: Learning with Trees: Decision Trees, Constructing Decision Trees using Gini Index (Regression), Classification and Regression Trees (CART)<br>2.3: Performance Metrics: Confusion Matrix, [Kappa Statistics], Sensitivity, Specificity, Precision, Recall, F-measure, ROC curve | 09 |
| 3. | **Ensemble Learning** | 3.1: Understanding Ensembles, K-fold cross validation, Boosting, Stumping, XGBoost<br>3.2: Bagging, Subagging, Random Forest, Comparison with Boosting, Different ways to combine classifiers | 06 |
| 4. | **Learning with Classification** | 4.1: Support Vector Machine<br>Constrained Optimization, Optimal decision boundary, Margins and support vectors, SVM as constrained optimization problem, Quadratic Programming, SVM for linear and nonlinear classification, Basics of Kernel trick.<br>4.2: Multiclass Classification, K-Nearest Neighbors, Naive Bayes Classifier, Random Forest | 07 |
| 5. | **Learning with Clustering** | 5.1: Introduction to clustering with overview of distance metrics and major clustering approaches.<br>5.2: Centroid-based clustering: K-means clustering algorithm; Model based Clustering: Expectation Maximization Algorithm, Density Based Clustering: DBSCAN | 07 |
| 6. | **Dimensionality Reduction** | 6.1: Dimensionality Reduction Techniques, Principal Component Analysis, Linear Discriminant Analysis, Singular Value Decomposition. | 06 |

**DETAILED LAB SYLLABUS:**

**Lab Prerequisite: Data Structures, Analysis of Algorithms**
**Suggested List of Experiments:**

| Sr. No | Title of Experiment |
|---|---|
| 1 | To implement Linear Regression. |
| 2 | To implement Logistic Regression |
| 3 | To implement Ensemble learning (bagging/boosting) |
| 4 | To implement multivariate Linear Regression. |
| 5 | To implement Naive Bayes Classifier with sample dataset and evaluate it using various performance measure |
| 6 | Construction of Decision Tree using Gini Index |
| 7 | To implement K-Means clustering using sample dataset |
| 8 | To implement SVM. |

Aom. Yr 23-24

| | |
|---|---|
| 9 | To implement PCA/SVD/LDA. |
| 10 | To implement DBSCAN |
| 11 | Implementation of Multiclass Classification using SVM |
| 12 | Implementation of Random Forest Algorithm |
| 13. | Implementation of Classification and Regression Trees (CART) |

**Theory Assessments:**

**1. Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.

**2. End Sem Theory Examination:**

- Question paper will consist of 4 questions, each carrying 20 marks.
- Total 3 questions need to be solved.
- Q.1 will be compulsory, based on the entire syllabus.
- Remaining questions will be randomly selected from all the modules.
- Weightage of marks should be proportional to number of hours assigned to each module.

**Lab Assessment:**

1. **Termwork Assessment:** Term Work shall consist of at least 8 to 10 experiments based on the above list. Also Term work Journal must include at least 2 assignments. Term Work Marks: 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance). The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.
2. **Oral/Viva Assessment:** An oral exam will be held based on the above syllabus.

**Text Books:**


1. Peter Harrington, ―Machine Learning n Action‖, DreamTech Press
2. Ethem Alpaydın, ―Introduction to Machine Learning‖, MIT Press
3. Tom M. Mitchell, ―Machine Learning‖ McGraw Hill
4. Stephen Marsland, ―Machine Learning An Algorithmic Perspective‖, CRC Press


**References:**


1. Han Kamber, ―Data Mining Concepts and Techniques‖, Morgan Kaufmann Publishers
2. Margaret. H. Dunham, ―Data Mining Introductory and Advanced Topics, Pearson Education
3. Kevin P. Murphy , Machine Learning ― A Probabilistic Perspective‖
4. Samir Roy and Chakraborty, ―Introduction to soft computing‖, Pearson Edition.
5. Richard Duda, Peter Hart, David G. Stork, ―Pattern Classification‖, Second Edition, Wiley Publications.


Adm. Y 23-24

**Useful Digital Links :**

1. Data sets for Machine Learning algorithms: https://www.kaggle.com/datasets
2. Machine Learning repository- https://archive.ics.uci.edu/ml/index.php
3. Machine Learning from Coursera
4. https://towardsdatascience.com/machine-learning/home
5. Introduction to Machine Learning - IITKGP - Course (nptel.ac.in)

Adm. Y 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical /Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 317 | Big Data Analytics | 03 | 02 | -- | 03 | 01 | -- | 04 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | 1 | 2 | Average | | | | | |
| EC 317 | Big Data Analytics | 40 | 40 | 40 | 60 | 25 | -- | 25 | 150 |

**Course Objectives:**

1. To provide an overview of an exciting growing field of Big Data analytics.
2. To discuss the challenges traditional data mining algorithms face when analyzing Big Data.
3. To introduce the tools required to manage and analyze big data like Hadoop, NoSql MapReduce.
4. To teach the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability.
5. To introduce to the students several types of big data like social media, web graphs and data streams.
6. To enable students to have skills that will help them to solve complex real-world problems in decision support.

**Course Outcomes: Upon successful completion of the course students will be able to**

1. Explain the motivation for big data systems and identify the main sources of Big Data in the real world.
2. Demonstrate an ability to use frameworks like Hadoop, NOSQL to efficiently store, retrieve and process Big Data for Analytics.
3. Implement several Data Intensive tasks using the Map Reduce Paradigm
4. Apply several newer algorithms for Clustering Classifying and finding associations in Big Data
5. Design algorithms to analyze Big data like streams, Web Graphs and Social Media data.
6. Design and implement successful Recommendation engines for enterprises.

**Prerequisite:** Database Management System.

Adm. Y 23-24

**DETAILED THEORY SYLLABUS:**

| Sr. No. | Module | Detailed Content | Hours |
|---|---|---|---|
| 1. | **Introduction to Big Data** | Data Introduction to Big Data, Big Data characteristics, types of Big Data, Traditional vs. Big Data business approach, Big Data Challenges, Examples of Big Data in Real Life, Big Data Applications | 03 |
| 2. | **Introduction to Big Data Frameworks: Hadoop, NOSQL** | What is Hadoop? Core Hadoop Components; Hadoop Ecosystem; Overview of : Apache Spark, Pig, Hive, Hbase, Sqoop What is NoSQL? NoSQL data architecture patterns: Key-value stores, Graph stores, Column family (Bigtable) stores, Document stores, MongoDB | 07 |
| 3. | **MapReduce Paradigm** | MapReduce: The Map Tasks, Grouping by Key, The Reduce Tasks, Combiners, Details of MapReduce Execution, Coping With Node Failures. Algorithms Using MapReduce: Matrix-Vector Multiplication by MapReduce , Relational-Algebra Operations, Computing Selections by MapReduce, Computing Projections by MapReduce, Union, Intersection, and Difference by MapReduce, Computing Natural Join by MapReduce, Grouping and Aggregation by MapReduce, Matrix Multiplication, Matrix Multiplication with One MapReduce Step . Illustrating use of MapReduce with use of real life databases and applications. | 06 |
| 4. | **Mining Big Data Streams** | The Stream Data Model: A DataStream-Management System, Examples of Stream Sources, Stream Queries, Issues in Stream Processing. Sampling Data in a Stream : Sampling Techniques. Filtering Streams: The Bloom Filter Counting Distinct Elements in a Stream : The Count-Distinct Problem, The Flajolet-Martin Algorithm, Combining Estimates, Space Requirements . Counting Ones in a Window: The Cost of Exact Counts, The Datar-Gionis-IndykMotwani Algorithm, Query | 06 |
| 5. | **Big Data Mining Algorithms** | Frequent Pattern Mining : Handling Larger Datasets in Main Memory Basic Algorithm of Park, Chen, and Yu. The SON Algorithm and MapReduce. Clustering Algorithms: CURE Algorithm. Canopy Clustering, Clustering with MapReduce Classification Algorithms: Parallel Decision trees, Overview SVM classifiers, Parallel SVM, KNearest Neighbor classifications for Big Data, One Nearest Neighbour. | 08 |
| 6. | **Big Data Analytics Applications** | Link Analysis : PageRank Definition, Structure of the web, dead ends, Using Page rank in a search engine, Efficient computation of Page Rank: PageRank Iteration Using MapReduce, Topic sensitive Page Rank, link Spam, Hubs and Authorities, HITS Algorithm. Mining Social- Network Graphs : Social Networks as Graphs, Types , Clustering of | 09 |

Adm. 2023-24

| | | | |
|---|---|---|---|
| | | Social Network Graphs, Direct Discovery of Communities, Counting triangles using Map-Reduce. Recommendation Engines: A Model for Recommendation Systems, Content-Based Recommendations, Collaborative Filtering. | |

**DETAILED LAB SYLLABUS:**

**Software Requirements:** Virtual Machine, Hadoop Frame work, NOSQL and MongoDb Compilers

**Hardware Requirements:** PC i3 or above, 8 GB RAM

| Sr. No. | Detailed Lab Description |
|---|---|
| 1 | Assignment on Study of Hadoop ecosystem |
| 2 | Programming exercises on Hadoop Using Hive, Pig, Hbase Sqoop NOSQL, MongoDB |
| 3 | Implementing simple algorithms in MapReduce Matrix multiplication, Aggregates, joins, sorting, searching etc. |
| 4 | ● Implementing Algorithms using MapReduce (Any 2)<br>● Implementing Frequent Item set Mining<br>Implementing Clustering algorithms Implementing Classification Algorithms |
| 5 | Big Data Applications (Any 2)<br>● Implementing Analytics on data streams<br>● Implementing Social Network Analysis Algorithms<br>Implementing Web Graph Algorithms Implementing recommendation Engines |
| 6 | Mini Project: One real life large data application to be implemented (Use standard Datasets available on the web) a) Twitter data analysis b) Fraud Detection c) Text Mining d) Recommendation Engines (list of datsets also given in the text book) |

**Theory Assessments:**

**1. Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.

**2. End Sem Theory Examination:**

- Question paper will consist of 4 questions, each carrying 20 marks.
- Total 3 questions need to be solved.
- Q.1 will be compulsory, based on the entire syllabus.
- Remaining questions will be randomly selected from all the modules.
- Weightage of marks should be proportional to number of hours assigned to each module.

**Lab Assessments:**

1. **Termwork Assessment:** Term Work shall consist of at least 10 to 12 practical's based on the above list. Also Term work Journal must include at least 2 assignments. Journal must include at least 2 assignments. Term Work Marks: 25 Marks (Total marks) = 15 Marks

Admn. AY 23-24

(Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance) Oral Examination will be based on the above syllabus.

2. **Oral/Viva Assessment**: An oral exam will be held based on the above syllabus.

**Text Books:**


**1.** Radha Shankarmani, M Vijayalakshmi, ”Big Data Analytics”, Wiley Publications
2. Anand Rajaraman and Jeff Ullman “Mining of Massive Datasets”, Cambridge University Press.
3. Alex Holmes “Hadoop in Practice”, Manning Press, Dreamtech Press.
4. Professional NoSQL Paperback, by Shashank Tiwari, Dreamtech Press.
5. MongoDB: The Definitive Guide Paperback, Kristina Chodorow (Author), Michael Dirolf, O'Reilly Publications.


**References:**


1. Analytics in a Big Data World: The Essential Guide to Data Science and its Applications, Bart Baesens , WILEY Big Data Series.
2. Big Data Analytics with R and Hadoop by Vignesh Prajapati Paperback, Packt Publishing Limited
3. Hadoop: The Definitive Guide by Tom White, O'Reilly Publications
4. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data by EMC Education Services
5. NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence by Pramod J. Sadalage, Addison Wesley


Adm. Y23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical /Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 318 | Parallel Computing Architecture | 03 | 02 | -- | 03 | 01 | -- | 04 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | Test1 | Test 2 | Avg. of 2 Tests | | | | | |
| EC 318 | Parallel Computing Architecture | 40 | 40 | 40 | 60 | 25 | -- | 25 | 150 |

**Course Objectives:**

1. To understand the principles of parallel computer architecture.
2. To understand the design of parallel computer systems including modern parallel architectures.
3. To assess the communication and computing possibilities of parallel system architecture and to predict the performance of parallel applications.

**Course Outcomes: Upon successful completion of the course students will be able to**

1. Students get accustomed with the representation of data, addressing modes, and instruction sets.
2. Students are able to understand parallelism both in terms of a single processor and multiple processors.
3. Technical knowhow of parallel hardware constructs to include instruction-level parallelism for multi core processor design.

**Prerequisite:** Computer Organization & Architecture

**DETAILED THEORY SYLLABUS:**

| Sr. No. | Module | Detailed Content | Hours |
|---|---|---|---|
| 1. | **Fundamentals of Computer Design** | Defining Computer Architecture – Trends in Technology – Trends in Power in Integrated Circuits – Trends in Cost – Dependability – Measuring, Reporting and Summarizing Performance – Quantitative Principles of Computer Design – Basic and Intermediate concepts of pipelining – Pipeline Hazards. | 04 |
| 2. | **Introduction to Parallel Processing** | Parallel computing structure, scope of parallel computing, architectures classification schemes, applications of parallel processing. | 06 |

Adm. Y 23-24

| | | | |
|---|---|---|---|
| 3. | **Memory and Input output subsystems** | Memory structure Hierarchy, Addressing scheme for main memory, Virtual Memory systems, Memory allocation and management strategies, Virtual Memory, Cache Memory, Management and Design criteria, I/O subsystems, Interrupt mechanisms, Vector processing requirements. | 08 |
| 4. | **Pipelining** | Principles of pipelining, vector processing: Pipelining, Instruction and Arithmetic pipelines, principles of designing pipelined processors, vector processing requirements<br>Pipeline computers and Vectorization methods: Vectorization and Optimization methods. | 07 |
| 5. | **SIMD and MIMD** | SIMD computers and Performance enhancement: Study of SIMD array processor and associative processor, Scientific attached processor.<br>MIMD: Architecture and memory organization of MIMD and Interconnection N/W.<br>Data Driven computing, Data Flow Computer Architecture. | 08 |
| 6. | **Parallel Software Environment** | Parallel Algorithm, features of Parallel Languages, Parallel compiler and OS. | 06 |

**Theory Assessments:**

**1. Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.

**2. End Sem Theory Examination:**

- Question paper will consist of 4 questions, each carrying 20 marks.
- Total 3 questions need to be solved.
- Q.1 will be compulsory, based on the entire syllabus.
- Remaining questions will be randomly selected from all the modules.
- Weightage of marks should be proportional to number of hours assigned to each module.

**Lab Assessments:**

1. The distribution of marks for term work shall be as follows:
    - Lab Performance (Experiments /case studies): 15
    - Assignment 05
    - Attendance (Theory & Practical) 05

**2.** Oral/Viva Assessment: Based on the above contents and entire syllabus.

**Text Books:**


1. David.A.Patterson, John L.Hennessy, "Computer Architecture: A Quantitative approach", Elsevier, 5th Edition 2012.
2. K.Hwang, Naresh Jotwani, “Advanced Computer Architecture, Parallelism, Scalability, Programmability”, Tata McGraw Hill, 2nd Edition 2010
3. D.Culler and J. Singh, Parallel Computer Architecture: A Hardware/Software Approach, Morgan Kaufmann, 1999.


Adm. Y 23-24

4. J. L. Hennessy and D. A. Patterson. Computer Architecture: A Quantitative Approach. Morgan-Kaufmann publishers.
5. A.Grama, A. Gupta, G. Karypis, and V. Kumar, Introduction to Parallel Computing, 2nd Edition, Pearson: Addison-Wesley, 2003. Errata is available by John Kirk.
6. P.Pacheco, An Introduction to Parallel Programming, Morgan Kaufmann, 2011.

Adm. Y 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical /Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 319 | Wireless Networks | 03 | 02 | -- | 03 | 01 | -- | 04 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | 1 | 2 | Avg. | | | | | |
| EC 319 | Wireless Networks | 40 | 40 | 40 | 60 | 25 | -- | 25 | 150 |

**Course Objectives:**

1. To get familiar with basic of wireless system.
2. To understand planning and design of various mobile and wireless networks.
3. To study various WPAN technologies like Bluetooth, Zigbee etc.
4. To explore basics of WAP.
5. To study basic fundamental of WLAN technologies.
6. To discuss introduction of 5G technology.

**Course Outcomes: Upon successful completion of the course students will be able to**

1. Get familiar with basic of wireless system.
2. Understand planning and design of various mobile and wireless networks.
3. Study various WPAN technologies like Bluetooth, Zigbee etc..
4. Explore basics of WAP.
5. Study basic fundamental of WLAN technologies.
6. Discuss introduction of 5G technology

**Prerequisite:** Wireless and mobile communication.

**Detailed Theory Syllabus:**

| Sr. No. | Module | Detailed Content | Hours |
|---|---|---|---|
| 1 | **Overview of Wireless System** | Advantages, limitations and application wireless media, Infrared Modulation Techniques, DSSS and FHSS, Frequency Spectrum: Radio and Infrared, Wireless generations: 1G: Cellular,2G: Mobile Radio, 3G: UMTS- Security related Encryption Algorithm | 05 |
| 2 | **Planning and design of WWANs** | Basics of fundamental of WWANs, Planning and design of wireless networks, Receiver sensitivity and link budget, Pole capacity of CDMA cell, Uplink and downlink radio link budget for CDMA system | 09 |

Adm. Y 23-24

| | | | |
|---|---|---|---|
| 3 | **WPANs (Low rate and high rate)** | Introduction to wireless PAN, Need of Wireless PAN, Bluetooth Technology: History & Applications, Technical Overview, Bluetooth Specifications, Piconet Synchronization, master-slave switch, Bluetooth security, Enhancements to Bluetooth: Bluetooth Interface issues, Intra & Inter Piconet Scheduling, Scatternet Formation, QoS Assignment, IEEE 802.15 Working group for WPAN, IEEE 802.15.3 & IEEE 802.15.4, Comparison between WPAN System & Comparison between WLAN & WPAN | 08 |
| 4 | **Basics of WAP** | Introduction to WAP, WML basics, Forms and user input, Data base driven WAP | 04 |
| 5 | **Fundamentals of WLANs** | Introduction to wireless LAN, Transmission Techniques, Medium Access Control Protocol Issues: Hidden Terminal Problem, Reliability, Collision Avoidance, Congestion Avoidance, Congestion Control, Energy Efficiency, IEEE 802.11 Standard for Wireless LAN: Network Architecture, Physical Layer, MAC Layer, Security, System design and considerations, Enhancements to IEEE 802.11 MAC: Power Control, Spatial Reusability & QoS Provisioning | 09 |
| 6 | **Introduction to 5G** | Salient features of 5G , 5G technology, 5G Architecture, Advantages and disadvantages, Applications, 5G Advancements, 5G Challenges, 5G future scope | 04 |

**DETAILED LAB SYLLABUS:**

**Software Requirements:**

1. Ns-2: http://www.isi.edu/nsnam/ns/
2. Virtual Lab : http://vlab.amrita.edu/index.php?sub=78&brch=256
3. Scilab Experiments Book: https://www.google.co.in/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0ahUKEwjgwcelodTTAhVJrI8KHTQUC9AQFggqMAA&url=http%3A%2F%2Fscilab.in%2Ftextbook_companion%2Fenerate_book%2F3446&usg=AFQjCNGDs2a6AHGKL93l3_j8Ra1UN-5SQQ&sig2=yT9ep5_ZlhfRDVsv-GmsWw&cad=rja

**Online Repository Sites:**

1. Google Drive
2. GitHub
3. Code Guru

| Sr. No. | Detailed Lab Description |
|---|---|
| 1 | Study of Hardware and Software aspects of Wireless Network. |
| 2 | Study, discussion and installation of different network simulation tools such as NS2/NS3,Netstumbler, Wireshark etc. |
| 3 | Analysis of Zigbee Network to compute the energy efficiency of the network. |
| 4 | Simulation of a simple wireless network (IEEE802.11) using NS2 or any other simulator. |
| 5 | Configuration of WPAN using Xbee S2 series modules and XCTU software. |
| 6 | Use of wireshark to capture WiFi or Bluetooth packets. |
| 7 | Configuration of WLAN. |

AUTONOMY 2024

| | |
|---|---|
| 8 | Analysis of WiFi network to compute average end to end delay and packet delivery ratio. |
| 9 | Link budget analysis of a GSM Network using Scilab / Matlab. |
| 10 | Link budget analysis of a WCDMA Network using Scilab / Matlab. |
| 11 | Simulation of Wireless Sensor Network (IEEE802.15.4)in NS2 or any other simulator. |

**Theory Assessments:**

1. **Internal Assessment**: Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.
2. **End Sem Theory Examination:**

- Question paper will consist of 4 questions, each carrying 20 marks.
- Total 3 questions need to be solved.
- Q.1 will be compulsory, based on the entire syllabus.
- Remaining questions will be randomly selected from all the modules.

Weightage of marks should be proportional to number of hours assigned to each module

**Lab Assessments:**

**1.Term work Assessment:**

- Term work should consist of 10 experiments.
- Journal must include at least 2 assignments

Total 25 Marks (Experiments: 10-marks, Attendance Theory& Practical: 05-marks, Assignments: 10-marks)

**2.Oral/Viva Assessment**:

Based on the above contents and entire syllabus.

**Text Books:**


1. Vijay K. Garg, “Wireless Communication and Networking”, Morgan -Kaufmann
2. Series in Networking—Elsevier
3. Theodore S. Rappaport, “wireless communications - principles and practice”, PEARSON, Second edition.
4. T L Singal ,“Wireless Communications”, Mc Graw Hill Education.
5. Fundamentals of 5G Mobile Networks: Jonathan Rodriguez (Ist Edition), Wiley Publication


**References:**


1. WAP Development with WML and WML Script: Ben Forta and Keith
2. Dr SunilkumarS. Manvi, Mahabaleshwar S. Kakkasageri, “Wireless and Mobile
3. Networks Concepts and Protocol”, Wiley India Pvt Ltd.
4. Raj Kamal, “Internet of Things Architecture & Design Principles” Mcgraw Hill
5. Kazem Sohraby, Daniel Minoli, and Taieb Znati, “Wireless Sensor Networks:
6. Technology, Protocols, and Applications”, Wiley Student Edition.


Adm. Y 23-24

| Course Code | Course Name | Scheme | Theory | Practical | Tutorial | Total |
|---|---|---|---|---|---|---|
| IL 374 | Digital Business Management and Digital Marketing | Contact Hours | 3 | - | - | 3 |
| | | Credits | 3 | - | - | 3 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal Assessment | | | End Sem Exam | | | | |
| | | IA 1 | IA 2 | Average | | | | | |
| IL 374 | Digital Business Management and Digital Marketing | 40 | 40 | 40 | 60 | - | - | -- | 100 |

**Course Objectives:**

1. To familiarize with digital business concepts.
2. To acquaint oneself with E-commerce.
3. To give insights into E-business and its strategies.
4. To understand digital marketing plans.

**Course Outcomes: After completion of this course, learner will be able to**

1. Identify drivers of digital business.
2. Illustrate various approaches and techniques for E-business and management.
3. Prepare an E-business plan.
4. Develop a digital marketing plan.

| Module | Detail Content | Hrs. |
|---|---|---|
| 1 | Introduction to E-Business, Making Functional Areas E-Business Enabled : Value chain and supply chain, inter and intra organizational business processes, ERP | 6 |
| 2 | Making Functional Areas E-Business Enabled : E-marketing, E-Selling, E-Supply Chain Management, E-Procurement. | 6 |
| 3 | Technologies for E-Business: Internet and Web based system,Security and payment systems,Supply chain integration technologies: EDI, RFID, Sensors, IoT, GPS, GIS; Supply chain integration technologies: Web services and cloud. | 8 |
| 4 | Marketing concept, Coordinated marketing, Meta marketing, Holistic marketing dimensions, : Case Analysis, Case Discussion; Marketing Environment. | 6 |
| 5 | Marketing decisions, Customer delivered value, Buyer Behaviour, Input - output map, Case Discussion, Marketing Planning, Price, Distribution, Advertising and Promotion, Case Discussion. | 8 |
| 6 | Marketing mix, Product policy, New products, PLC, Marketing organization, Product Management. | 5 |

**Assessment:**

Draft: AY 23-24

**Internal Assessment: 40 marks**
**End Semester Examination: 60 Marks**

**Books/References:**


1. Digital Business and E-Commerce Management, 6th Ed, Dave Chaffey, Pearson, August 2014.
2. Management Information Systems: Managing the Digital Firm, Laudon and Laudon, Pearson
3. Marketing Management- Analysis, Planning and Control, Prentice Hall,14th Edition, 2015
4. NPTEL Course on E-business; https://onlinecourses.nptel.ac.in/noc24_mg16/preview; Refer Week 1 and Week 2 for Module 1; Week 3 and Week 4 for Module 2; and Week 5, Week 6 and Week 7 for Module 3.
5. NPTEL Course on Integrated Marketing Management; https://onlinecourses.nptel.ac.in/noc24_mg27/preview
6. Refer Week 1 and Week 2 for Module 4; Week 3 and Week 4 for Module 5; and Week 5, Week 6 and Week 7 for Module 6.


Adm. Y 23-24

| Course Code | Course Name | Scheme | Theory | Practical | Tutorial | Total |
|---|---|---|---|---|---|---|
| IL 375 | Business Analytics | Contact Hours | 3 | - | - | 3 |
| | | Credits | 3 | - | - | 3 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal Assessment | | | End Sem Exam | | | | |
| | | IA 1 | IA 2 | Average | | | | | |
| IL 375 | Business Analytics | 40 | 40 | 40 | 60 | - | - | -- | 100 |

**Course Objectives:** The course is aimed to

1. To understand the importance of business analytics .
2. To learn how to explore and summarize the data with statistical methods.
3. To study how to represent and process the data.
4. To provide hands-on experience with data visualization techniques and hypothesis testing.
5. Discuss the ethical implications of data privacy and security in business analytics.
6. Encourage critical thinking and problem-solving skills through practical applications.

**Course Outcomes:** On successful completion of course learner/student will be able to

1. Understand the fundamentals of business analytics.
2. Students will be able to evaluate the quality of data and its impact on analytical outcomes.
3. Apply statistical techniques to analyze data
4. Creation of informative data visualizations and draw meaningful conclusions from testing.
5. Demonstrate ethical decision-making skills when faced with ethical dilemmas in business analytics.
6. Apply analytical techniques learned throughout the course to solve real-world business problems.

| Module | Detail Content | Hrs. |
|---|---|---|
| 1 | **Introduction to Business Analytics** : Definition, scope and importance of business analytics, introduction to business planning, types of plans, levels of planning, overview of analytical tools and techniques. | 3 |
| 2 | **Exploring Data:** Introduction to different types of data (structured, semi-structured, and unstructured data).<br>Extract, transform and load (ETL) data - ETL fundamentals, data extraction, data transformation, data mapping and Conversion. descriptive statistics measure of central tendency (mean, median, mode) and dispersion (variance, standard deviation), probability theory, conditional probability and bayes' theorem, random variables and probability distributions: discrete (binomial, poisson) and continuous | 7 |

Adm. y 23-24

| | | |
|---|---|---|
| | (normal, exponential) distributions. | |
| 3 | **Statistical Analysis:** Business analytics with excel: importance of excel functionalities, analysis with pivot tables, dashboard creation. Statistical analysis with Python, correlation and regression analysis, time series analysis. | 6 |
| 4 | **Data visualization and Hypothesis testing:** Principles of effective data visualization, tableau for business Intelligence- tableau workspace and types of charts, data preparation and chart creation, filters and analytics in Tableau, tableau dashboards.<br>Understanding UML diagrams, UMLtools for Business process analysis BPMN (Business Process Model and Notation) in business process Analysis, BPMN diagrams.<br>Null and alternative hypotheses: Formulating hypotheses for testing (anova, chi-square tests, t-tests). | 10 |
| 5 | **Ethical considerations in Business Analytics:** Privacy, security and confidentiality of data, bias and fairness of data, Types of biases ( sampling bias, selection bias, algorithmic bias) and their impact on analytics, strategies for detecting and mitigating biases in data, transparency and Accountability of data. | 5 |
| 6 | **Application and case studies:** Real-world case studies in various industries (e.g., Customer segmentation and targeting, Market forecasting, Social media analytics, Fraud detection, Demand forecasting, Customer churn analysis etc.)<br>Application of analytics techniques to solve business problems | 8 |

**Assessment:**
Internal Assessment: 40 marks
End Semester Examination: 60 Marks

**Books and References:**


1. Business Analytics: A Practitioner's Guide" by Sandhya Kuruganti and Ram Ramesh
2. "Business Analytics: Data Analysis and Decision Making" by S. Christian Albright and
   Wayne L. Winston
3. "Business Analytics: The Science of Data-Driven Decision Making" by U Dinesh Kumar
4. Ethical Data and Information Management: Concepts, Tools, and Methods" by Katherine
   O'Keefe
5. “Princip and Practice of Management”, by J.S. Chandan, SK Mandal, Vikas Publishing
   House.
6. “Business Analytics”, by Dr. Mohd Imran Khan, Published By : Lovely Professional University.


Adm. y 2324

| Course Code | Course Name | Scheme | Theory | Practical | Tutorial | Total |
|---|---|---|---|---|---|---|
| IL 376 | Biomechanics | Contact Hours | 3 | - | - | 3 |
| | | Credits | 3 | - | - | 3 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal Assessment | | | End Sem Exam | | | | |
| | | IA 1 | IA 2 | Average | | | | | |
| IL 376 | Biomechanics | 40 | 40 | 40 | 60 | - | - | -- | 100 |

**Course Objectives:**

1. Introduce basic biomechanical terminologies and principles relevant to the human body.
2. Analyze the kinematics and forces acting on muscles and joints using free-body diagrams.
3. Perform biomechanical assessments of the upper and lower limb joints to understand movement mechanics.
4. Examine the mechanical properties of hard and soft tissues and their implications for human movement.

**Course Outcome:** Students will be able to

1. Accurately define key biomechanical terms.
2. Effectively create and interpret free-body diagrams for joint analysis.
3. Analyze joint mechanics in the upper limb and lower limb, identifying critical forces.
4. Apply gait analysis principles to differentiate between healthy and pathological movement patterns.
5. Explain the mechanical properties of hard tissues and their relevance to biomechanics.
6. Examine biofluid mechanics and blood flow dynamics in the cardiovascular system.

| Module | Detail Content | Hrs. |
|---|---|---|
| 1 | **Introduction:**<br>Introductory Mechanics – Statics and Dynamics – Basic Principles.<br>The human body as a biomechanical system – basic terminologies | 6 |
| 2 | **Joint Mechanics:**<br>Kinematics of muscles and joints - free-body diagrams and equilibrium, forces and stresses in joints<br>Biomechanical analysis of joints of upper limb - Shoulder, Elbow, wrist, hand and fingers | 7 |
| 3 | **Analysis of Joints:**<br>Upper limb as a mechanical system – analysis of reaching as movement of a multi-link serial chain – forward kinematics, analysis of fingertip forces as a parallel manipulator<br>Biomechanical analysis of joints – Spine, Hip, Knee, Ankle. | 7 |
| 4 | **Gait Analysis:**<br>Introduction to Postural stability and Gait analysis. | 6 |

Admy 23-24

| | | |
|---|---|---|
| | Gait analysis in health and disease - basics. | |
| **5** | **Tissue Mechanics:**<br>Mechanics of Hard Tissues - Definition of Stress and Strain, Deformation Mechanics, structure and mechanical properties of bone - cortical and cancellous bones, Wolff's law of bone remodeling;<br>Soft Tissues - Structure, functions, material properties – tendon function, elasticity in a tendon, models of non-linear elasticity in a tendon – physiological and non-physiological regimes, Davis' law of soft tissue remodeling. | 7 |
| **6** | **Biofluid mechanics:**<br>Visco-elastic properties of soft tissues, Models of visco-elasticity: Maxwell & Voight models. Basic Biofluid mechanics - Flow properties of blood in the intact human cardiovascular system. | 6 |

**Assessment:**
Internal Assessment: 40 marks
End Semester Examination: 60 Marks

**Books/References:**


1. David A. Winter, Biomechanics and Motor Control of Human Movement .
2. Margareta Nordin and Victor H. Frankel, Basic Biomechanics of the Musculoskeletal System.
3. Francisco Valero-Cuevas, Fundamentals of Neuromechanics.
4. Susan Hall, Basic Biomechanics.
5. Irving Hermann, Physics of Human Body.


Adm. -24

| Course Code | Course Name | Scheme | Theory | Practical | Tutorial | Total |
|---|---|---|---|---|---|---|
| IL 377 | Medical Image Processing | Contact Hours | 3 | - | - | 3 |
| | | Credits | 3 | - | - | 3 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal Assessment | | | End Sem Exam | | | | |
| | | IA 1 | IA 2 | Average | | | | | |
| IL 377 | Medical Image Processing | 40 | 40 | 40 | 60 | - | - | -- | 100 |

**Course Objectives:**

1. To introduce the learners to the basic theory of digital image processing.
2. To expose learners to various available techniques and possibilities of this field.
3. To prepare learners to formulate solutions to general image processing problems.

**Course Outcomes:** Learner will be able to

1. Record, extract and analyse key information about teeth, muscles, bones etc
2. Acquire the fundamental concepts of a digital image processing
3. Analyze images in the spatial and frequency domain.

| Module | Detail Content | Hrs. |
|---|---|---|
| 1 | **Medical Imaging Systems:** Properties, advantages and disadvantages of X-rays based imaging systems, Magnetic Resonance Imaging (MRI) imaging, Gamma-rays based imaging systems, Positron emission tomography (PET), Single-photon emission computerized tomography (SPECT) scan, Computed Tomography (CT) scan, Ultrasound (sonography), Endoscopy, and Thermography based imaging systems. Difference between different medical imaging systems. Nature of Biomedical images, Objectives of biomedical image analysis, Difficulties in biomedical image acquisition and analysis. | 7 |
| 2 | **Medical Imaging Toolkits:** ImageJ (and/or FIJI), ITK-Snap, SimpleITK, MITK, FreeSurfer, SLICER, OsiriX. Image Formats: dicom (.dcm), Nifti (.nii), Minc (.mnc), Analyze (img/hdr), Raw (.raw), MHD (.mhd) and MHA (.mha) | 5 |
| 3 | **Medical Image Detection and Recognition:** Medical image parsing, Deep Learning for Medical Image Recognition, Automatic Interpretation of Carotid Intima–Media Using Convolutional Neural Networks, Deep Cascaded Networks for Sparsely Distributed Object Detection, Deep Voting and Structured Regression for Microscopy Image Analysis. | 6 |
| 4 | **Medical Image Registration:** Intensity-based methods, Cost functions - correlation, least squares, mutual information, robust estimators. Optimization techniques - fixed-point iteration, gradient descent, Nelder-Mead simplex method. MRI motion compensation, Convolutional Neural Network for Robust and Real-Time 2-D Registration. | 6 |
| 5 | **Medical Image Segmentation Networks:** | 9 |

AY 23-24

| | | |
|---|---|---|
| | Comparative study and analysis of U-Net family of segmentation: U-Net, V-Net, 3D U-Net, H-DenseUNet, GP-Unet, UNet++, MDU-Net, DUNet, RA-UNet, nnU-Net, SUNet, IVD-Net, LADDERNET, Attention U-Net, R2U-Net, MultiResUNet, U-NetPlus, CE-Net, CIA-Net, U2-Net, ScleraSegNet, AHCNet, MFP-Unet, ResUNet-a, RAUNet, 3D U2-Net, SegNAS3D, U^2-Net, UNET 3+. | |
| 6 | **Deep Learning for Healthcare:** Deep learning for different healthcare applications: Diabetic Retinopathy, Knee Osteoarthritis, Histological and Microscopic Elements Detection, Gastrointestinal Diseases Detection, Cardiac Imaging. Lesion detection: Brain tumor detection, prostate lesion detection, Lung nodule detection. | 6 |

**Assessment:**
Internal Assessment: 40 marks
End Semester Examination: 60 Marks

**Books/References:**


1. W. Birkfellner, Applied Medical Image Processing: A Basic Course, CRC Press , Second Edition, 2014
2. I. Bankman, Handbook of Medical Image Processing and Analysis, Academic Press , Second Edition, 2008
3. Rangaraj M. Rangayyan, “Biomedical Image Analysis”, CRC Press, 2000.
4. Zhou et al “Deep learning for Medical image analysis” Elsevier 2018.
5. R. C. Gonzalez, Digital Image Processing, Pearson Education India , Third Edition, 2013
6. S. Jayaraman, T. Veerakumar, S. Esakkirajan, Digital Image Processing, McGraw Hill Education , 2017
7. A K Jain, “Fundamental of Digital Image Processing”, Prentice Hall, 2002.


Adm. Y 23-24

| Course Code | Course Name | Scheme | Theory | Practical | Tutorial | Total |
|---|---|---|---|---|---|---|
| IL 378 | Product Design | Contact Hours | 3 | - | - | 3 |
| | | Credits | 3 | - | - | 3 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal Assessment | | | End Sem Exam | | | | |
| | | IA 1 | IA 2 | Average | | | | | |
| IL 378 | Product Design | 40 | 40 | 40 | 60 | - | - | -- | 100 |

**Course Objectives:**

1. To familiarize with fundamental product design concepts
2. To acquaint with product design methodologies
3. To understand product design needs and issues in industry

**Course Outcomes:** Learner will be able to

1. Demonstrate product design and development process.
2. Analyze a product in perspective of aesthetic and ergonomic considerations.
3. Illustrate considerations of Design for Manufacturing and Assembly in product development.
4. Apply appropriate tools and techniques in the design of solutions that are usable and functional for various applications.
5. Design the products as per the customer/industry requirements
6. Apply principles of economy and demonstrate legal and social issues pertaining to product development.

| Module | Detail Content | Hrs. |
|---|---|---|
| 1 | Product definition, specification, Phases of product development: conceptual, embodiment and detailed design, product and technology development cycle, Concept generation and evaluation methods, product architecture, Product life cycle Management with case studies, Product analysis.<br>Creativity and Idea generation technique, importance of Quality Dimensions: Performance, Features, aesthetics, Ergonomics, Reliability, Sustainability, Serviceability, Brand value, Value Vs cost, Importance of shape, color, feature & Resemblance. | 6 |
| 2 | Design Factors: Ergonomics, Aesthetics, Anthropometry, Comforts, Economic factors<br>Axiomatic design principles and case studies.<br>Design Thinking, Design by Innovation and collaboration<br>Material and Process selection Methods, Expert systems. Computer Database Approach, performance indices decision matrix, AHP and fuzzy approach, Introduction to material and process selection software. | 6 |

Draft - 23-24

| | | |
|---|---|---|
| 3 | Design for Manufacturing (DFM) and Design for Assembly (DFA)<br>Designs for Maintainability and Reliability and some methods for reliability assessment, Designs for Environment, Design for Robustness: Taguchi Designs & Design of Experiments (DOE). | 8 |
| 4 | Product Design Tools and Techniques:<br>Value Engineering / Value Analysis: definition, methodology- FAST, Benchmarking, Supplier involvement robust design, QFD, Design & process FMEA. Reverse Engineering, Concurrent engineering & Sequential engineering, Case studies. | 8 |
| 5 | Product Development Cycle and Importance of Prototyping. Types of prototypes. Principal and advantages & Different Type of Generative Manufacturing process, Viz. Stereo lithography. FDM, SLS etc. Factors Concerning to RP: Consideration for Adoptions, Advantages, Accuracy and Economic Consideration.<br>Introduction to Assembly Modeling, Top-Down and Bottom-Up Approaches of AM, Mating Conditions, representation Schemes. Generation of Assembly Sequences. Case studies | 6 |
| 6 | Economics of Product Development: Product costing, Principals of Economy, Engineering Economy and Design Process, Economic Analysis, Inflation, Time Value of Money, Numerical on Internal Rate of Return and Net Present Value (NPV) method.<br>Legal and social issues, Patents and IP acts. | 6 |

**Assessment:**
Internal Assessment: 40 marks
End Semester Examination: 60 Marks

**Reference Books:**


1. Product Design and Manufacturing by A.K.Chitale, R.C.Gupta, PHI.
2. Product Design and Development by Ulirich Karl T. and Eppinger Steven D, McGraw Hill.
3. Engineering Design by Dieter George E., McGraw Hill.
4. Handbook of Product Design for Manufacturing by Bralla, James G, McGraw Hill.
5. Product Design by Kevin Otto & Kristin Wood


Adm. Y 23-24

| Course Code | Course Name | Scheme | Theory | Practical | Tutorial | Total |
|---|---|---|---|---|---|---|
| IL 379 | Technologies for Rural Development | Contact Hours | 3 | - | - | 3 |
| | | Credits | 3 | - | - | 3 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal Assessment | | | End Sem Exam | | | | |
| | | IA 1 | IA 2 | Average | | | | | |
| IL 379 | Technologies for Rural Development | 40 | 40 | 40 | 60 | - | - | -- | 100 |

**Course Objectives:**

1. To understand the concept of rural technology
2. To understand the characteristics of rural resources and its importance in Rural Development.
3. To understand various technologies required for Rural Development
4. Rural planning and implementation of rural development projects
5. To generate awareness regarding government policies (monitoring and documentation).

**Course Outcomes:** Learner will be able to

1. Understand various natural resources and their importance in rural development.
2. Get exposure to various challenges and problems with regard to availability and use of natural resources.
3. Develop and implement various technologies for rural development
4. Explore various schemes for rural development

| Module | Detail Content | Hrs. |
|---|---|---|
| 1 | **Rural Resources-**<br>Understanding the Characteristics and nature of Rural Recourses Importance of different resources in Rural Development. Natural resource management(NRM) | 3 |
| 2 | **Concept of Information and Communication Technologies (ICT's) in Rural Development-**<br>Evolution of ICT's, Communication Functions of ICT's, Nature and Scope of ICT's, Information Haves and Information Have Nots in the Rural Areas, Strengths and Weaknesses of ICT's in Rural India, Application of ICT's for Rural Development in India, Satellite Communication support for Rural Development, Telecommunication support for Rural Development, Computer Communication support for Rural Development | 6 |
| 3 | **Management Information System for Rural Development in India**<br>Basic concepts Role of MIS in the management of agricultural extension programmes Design of a MIS in an agricultural extension | 8 |

| | | |
|---|---|---|
| | organization<br>Need for automation ,Organization of a database Networking and interactive processing , End-user computing Illustrative computer-based MIS , Rural Energy system | |
| 4 | **The Role of Rural Technology** – Global approach in Innovative Rural technology Innovative technologies in Production and Postharvest management, Innovation in productivity and Sustainable management(Bio fertilizer) Innovation Commercial Production Technologies<br>Technology for Rural Women, difficulties in adoption of rural technology. | 6 |
| 5 | **Globalisation of Rural Economy-** Globalisation and aims and objectives; Impact of Globalisation on rural economy, Design and Innovation in Integrated Rural Health Management, SEZ's and Agriculture. Agricultural value chain | 4 |
| 6 | **Government Schemes and initiatives-**<br>Various government schemes**,** participation of various Stake holders for development and Protection of Rural resources | 3 |

**Assessment:**
Internal Assessment: 40 marks
End Semester Examination: 60 Marks

**Books/References:**


1. Rural Resource Management: A Geographical Perspective by Paul Cloke (Author), C. Park
2. Rural Development: Principles, Policies and Management, Katar Singh, Sage Publications India Pvt. Ltd., 2009
3. Mosse, D., & Cooke, B. (2001). People's knowledge, participation and patronage: Operations and Representations in Rural Development.
4. ICTs: Digital Opportunities in Agricultural Extension, Dipaj De Basavaprabhu Jirli Shaik N. Meer
5. S.S. Singh., Principles and Practices of Agronomy. 1985. Kalyani Publishers, Ludhiana
6. Indian Economy by Datt, Rudra & Sundharam, New Delhi: S. Chand, 2008.
7. W.T.O and Indian Economy by Deogirikar, A. B. Jaipur: Shri Niwas Publications, 2004
8. S.S. Singh., Principles and Practices of Agronomy. 1985. Kalyani Publishers, Ludhiana
9. Indian Economy by Datt, Rudra & Sundharam, New Delhi: S. Chand, 2008.
10. W.T.O and Indian Economy by Deogirikar, A. B. Jaipur: Shri Niwas Publications, 2004
11. Maheshwari, S. (1985). Rural development in India: A Public Policy Approach. SAGE Publications Pvt. Limited.
12. Indian Economy by Datt, Rudra & Sundharam, New Delhi: S. Chand, 2008.
13. Government of India, "Various Five-Year Plans (1st to 12th)" Planning Commission, New Delhi


Adm. Y 23

| Course Code | Course Name | Scheme | Theory | Practical | Tutorial | Total |
|---|---|---|---|---|---|---|
| IL 380 | Economics | Contact Hours | 3 | - | - | 3 |
| | | Credits | 3 | - | - | 3 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal Assessment | | | End Sem Exam | | | | |
| | | IA 1 | IA 2 | Average | | | | | |
| IL 380 | Economics | 40 | 40 | 40 | 60 | - | - | -- | 100 |

**Course Objectives:**

1. Provide a good grounding in the basic concepts of Micro and Macroeconomics.
2. Familiarize learners with concept of demand, supply, price, income and equilibrium.
3. Teach students to represent Indifference curve in regular as well as in exceptional cases with respect to consumer behaviour, consumer preferences and Risk Aversion.
4. To inculcate the skills required to understand the concept of Production function with single and two variable inputs.
5. To create an awareness of the different market structures and its impact on the price and output of a product.
6. To prepare the learners in understanding the Keynesian System of Money, Interest and Income and its impact in society with respect to Inflation.

**Course Outcomes:** Learner will be able to

1. Acquire conceptual and theoretical knowledge of Micro and Macroeconomics and learn to think critically about issues and topics of the subject.
2. Demonstrate the understanding of the concepts of demand, supply, price, income and equilibrium and relate it to the existing scenario in the society.
3. Perform successfully in representing the Indifference curve in relation to the prevalent consumer behaviour and consumer preferences.
4. Illustrate the skills required for maximising output and minimising cost for effective production.
5. Determine the importance of the existence of different market structures and its impact in society.
6. Develop an understanding of the Keynesian System of Money, Interest and Income and formulate anti- inflationary policies.

| Module | Detail Content | Hrs. |
|---|---|---|
| 1 | Introduction to Micro and Macro Economics | 5 |
| 2 | Demand & Supply: Concept of demand & supply functions, Price, Income & Cross elasticities of demand, Elasticity of Supply, Market demand functions, Concept of equilibrium, Impact of changes in demand & supply on equilibrium | 7 |
| 3 | Theory of Consumer Behaviour: Concept of cardinal and ordinal utility, consumer's equilibrium, Consumer's preferences, Risk Aversion and Indifference Curve Analysis, & its properties, Shapes of Indifference Curves in exceptional cases | 7 |
| 4 | The Theory of Production: Concept of Production function, Production with a single variable input, Production with two variable inputs, | 6 |

Adm. AY 23-24

| | | |
|---|---|---|
| | Optimal input combination, Constrained output maximization, Cost minimization, Elasticity of substitution | |
| 5 | Theory of Cost: Different concept of cost, Short-run and Long- run cost analysis, modern concept. Market Structures a. Perfect Competition Short-run and long-run equilibrium of the firm and Industry, Stability of equilibrium, Concept of imperfect competition; short run and long run price and output decisions of a monopoly firm; concept of a supply curve under monopoly; comparison of perfect competition and monopoly, | 4 |
| 6 | The Keynesian System: Money, Interest and Income Money in the Keynesian theory, Interest Rate Determination (Liquidity Preference Theory), Money Market, Bond market and Commodity Market, Monetary policies and fiscal policies, Inflation and Unemployment Inflation, Role and Effects of inflation, Anti- inflationary policies | 7 |

**Assessment:**
Internal Assessment: 40 marks
End Semester Examination: 60 Marks

**Reference Books:**


1. Dr. Samwel Nyagucha Ores. (2019). *Micro and Macro Economics: Understanding the Basics of Economics*. New Generation Publishing.
2. Daron Acemoglu and James A. Robinson. (2013). *Why Nations Fail: The Origins of Power, Prosperity and Poverty*. Profile Books


Adm. Y 23-24

| Course Code | Course Name | Scheme | Theory | Practical | Tutorial | Total |
|---|---|---|---|---|---|---|
| IL 381 | Journalism, Media and Communication studies | Contact Hours | 3 | - | - | 3 |
| | | Credits | 3 | - | - | 3 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal Assessment | | | End Sem Exam | | | | |
| | | IA 1 | IA 2 | Average | | | | | |
| IL 381 | Journalism, Media and Communication studies | 40 | 40 | 40 | 60 | - | - | -- | 100 |

**Course Objectives:**

1. Provide a good grounding in the basic concepts of Journalism, Mass communication and Media.
2. Familiarize learners with reporting and editing practices.
3. Teach students to write editorials, feature articles, interviews, reviews, criticism etc.
4. To inculcate the skills required for writing in online newspapers, blogs, email and cell phone.
5. To prepare the learners for understanding the importance of Press laws and Ethics.
6. To train learners in advertising techniques and Public Relation Communication

**Course Outcomes:** Learner will be able to

1. Acquire conceptual and theoretical knowledge of Journalism, Mass Communication and Media Studies and learn to think critically about issues and topics of the subject.
2. Demonstrate the understanding of reporting and editing from Newspaper and the Organization.
3. Perform successfully in writing effective editorials, featured articles reviews etc.
4. Illustrate the skills required for writing in online newspapers, blogs, emails etc.
5. Determine the importance of Press Laws and Ethics.
6. Develop an understanding of the techniques required for advertising and Public Relation Communication.

| Module | Detail Content | Hrs. |
|---|---|---|
| 1 | Introduction to Journalism, Communication, Media and Cultural Studies- Basics of Mass communication, Pioneers of Indian Journalism, Introduction to newspapers, magazines and other publications. Introduction to broadcast journalism with special reference to television | 5 |
| 2 | Reporting and Editing Practices-Reporting different news, stories from Newspaper, and Organization. Principles of editing, rewriting, and translation | 7 |
| 3 | Writing for Print- Newspaper Content Writing Opinion pieces, editorials, feature articles, interviews, profiles, reviews, criticism etc. | 7 |
| 4 | Writing for Media- Introduction to New Media Writing for Online newspapers Blogs Cell phone Communication E-mail | 6 |
| 5 | Press Laws and Ethics- Origin and definition of Law, Law and Morality, Types of Law – Civil and Criminal, Press Legislations, Freedom of the Press Defamation Contempt of Court | 4 |

Acad. Yr 23-24

| | | |
|---|---|---|
| 6 | Public Relations and Advertising- Introduction to Public Relations Stages of PR Communication with Public Need and Meaning of Advertising, Advertising strategies and Sales Promotion | 7 |

**Assessment:**
Internal Assessment: 40 marks
End Semester Examination: 60 Marks

**Books/References:**


1. Rangaswamy, Parthasaratihi, (1985). *Journalism in India*, Sterling Publication, New Delhi.
2. Jeffrey, Robin, (2009). *India's Newspaper Evolution*, Oxford University Press, Delhi.
3. Singh, Devvrat. (2012). *Indian Television: Content, Issues and Challenges*, HarAnand Publications Delhi.
4. Daryl L. Frazell, George Tuck. (1996). *Principles of Editing: A Comprehensive Guide for Students and Journalists Principles of Editing: A Comprehensive Guide for Students and Journalists.* McGraw-Hill
5. Barry Newman. (2015). *News to Me: Finding and Writing Colorful Feature Stories*. Paperback
6. The Associated Press. (2017). *The Associated Press Stylebook: and Briefing on Media Law*. Revised, Updated Edition. Paperback.
7. Kristina Halvorson. (2012) *Content Strategy for the Web*, 2nd Edition. New Riders


Adm. Y 23-24

| Course Code | Course Name | Scheme | Theory | Practical | Tutorial | Total |
|---|---|---|---|---|---|---|
| IL 382 | Operation Research | Contact Hours | 3 | - | - | 3 |
| | | Credits | 3 | - | - | 3 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal Assessment | | | End Sem Exam | | | | |
| | | IA 1 | IA 2 | Average | | | | | |
| IL 382 | Operation Research | 40 | 40 | 40 | 60 | - | - | -- | 100 |

**Course Objectives:** The course is aimed

1. To acquaint the students with basics of Operation Research.
2. To learn the different Linear Programming methods.
3. To make the students aware of the topic "sensitivity Analysis"
4. To learn the different methods of solving Transportation & Assignment Problems.
5. To Understand sequencing Models & related Problems.
6. To explore the different methods used in Game Theory.

**Course Outcomes:** On successful completion of course learner/student will be able to apply:

1. The basic concepts of Operation Research to solve optimization problems..
2. The different Linear Programming methods to solve Problems.
3. The understanding of Linear Programming to sensitivity analysis.
4. The different methods to solve Transportation & assignment Problems.
5. The concept of sequencing models to related problems.
6. The understanding of Game Theory and solve related Problems.

**Detailed Theory Syllabus:**

| Module | Detailed Contents | Hrs. |
|---|---|---|
| 1 | **Introduction to Operation Research:** Canonical & standard form of a Linear Programming Problem, Simplex method , multiple solutions of L.P.P, Infeasible solution & unbounded solution | 6 |
| 2 | **Linear Programming Model:** Artificial variables , Big M-penalty method , Duality in Linear Programing, dual simplex method, revised simplex method. | 8 |
| 3 | **Sensitivity Analysis:** Changes in the right handside of the constraint equations ' $b_i$' changes in the cost coefficients '$c_j$' changes in the coefficients of the constraints '$a_{ij}$'. | 6 |
| 4 | **Transportation & Assignment Problems:** NorthWest Corner method , Vogel's approximation method, Hungarian method, maximization problem, unbalanced transportation problem | 8 |

Adm. AY 23-24

| | | |
|---|---|---|
| 5 | **Sequencing models & related Problems:** Processing n-jobs on two machines , processing n-jobs on m-machines | 6 |
| 6 | **Game Theory :** Two – person zero sum game with & without saddle points, solution of mixed strategy ganmes , Matrix reduction by dominance. | 5 |

**Assessment:**
Internal Assessment: 40 marks
End Semester Examination: 60 Marks

**Books and References:**


1. Operations Research : Prem Kumar Gupta , D.S.Hira ; S. Chand & company Ltd.
2. Operations Research ; An Introduction : Hamdy .A.Taha ; Prentice Hall of India
3. Introduction to Operation Research : Frederick.S.Hillier,Gerald.J.Lieberman McGraw Hill Education ( India) Private Ltd.
4. Operation Research : R. Paneerselvan, PHI Learning Private Ltd.


Adm. Y 23-24

| Course Code | Course Name | Scheme | Theory | Practical | Tutorial | Total |
|---|---|---|---|---|---|---|
| IL 383 | Climate Informatics | Contact Hours | 3 | - | - | 3 |
| | | Credits | 3 | - | - | 3 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal Assessment | | | End Sem Exam | | | | |
| | | IA 1 | IA 2 | Average | | | | | |
| IL 383 | Climate Informatics | 40 | 40 | 40 | 60 | - | - | -- | 100 |

**Course Objectives:**

1. To promote the safety, health, and welfare of people and the environment through engineering professionals.
2. To encourage students to be productive and contributing members of the environmental profession as practitioners, entrepreneurs, researchers, or teachers.
3. To develop environmental awareness among students that meet specified engineering needs with consideration of public health, safety, and welfare, as well as global, environmental, and legal factors.

**Course Outcomes:** On successful completion of the course learner/student will be able to:

1. Present the international climate change legal and policy framework and explain key issues under negotiation.
2. Describe the expected consequences of climate change and the role of adaptation.
3. Provide a rationale for climate change mitigation and propose actions in key sectors.
4. Identify main streams of climate change finance.
5. Outline basic elements of planning processes to deliver climate change action.
6. Analyse principal challenges and opportunities for climate change action.

| Module | Detailed Contents | Hrs |
|---|---|---|
| 1 | **Introduction to Climate Change Science:**<br>An overview of key concepts such as climate, weather and the greenhouse gas effect.<br>Human contribution to climate change and provides an overview of important greenhouse gases and their main sources.<br>The main observed changes in the climate since the industrial revolution. Future trends and impacts of climate change on surface temperature, ocean pH, and sea-level. | 5 |
| 2 | **Introduction to the International Legal and Policy Framework to address Climate Change:**<br>An overview of the international legal and policy framework to address climate change.<br>Brief history of international climate change negotiations and introduces the United Nations Framework Convention on Climate Change | 6 |

| | | |
|---|---|---|
| | (UNFCCC). Key provisions of the UNFCCC, its organisational structure, and different Party groups under the Convention.<br>The Kyoto Protocol and its associated bodies. | |
| 3 | **ICT Trends and their Implications for Tackling Climate Change:** Information Needs in Adaptation and Mitigation, Communication on Climate Change, Scope and Definition of ICTs, ICT Trends and their Implications for Tackling Climate Change, e-Waste and Recycling ,Green Computing | 6 |
| 4 | **Weather and Climate Informatics:**<br>**Climate Change and Climate Modelling:** Global environmental issues in climate change due to human activities or natural climate variations.<br>Understanding and Using Climate Data, The Climate data analysis, Seasonal Climate Forecasting, Climate Extremes, Uncertainty, and Impacts | 5 |
| 5 | **Data Challenges and Opportunities in Climate Informatics**: Issues with Cross-Class Comparisons, Climate System Complexity.<br>Challenge: Cloud-Computing-Based Reproducible Climate Data Analysis | 4 |
| 6 | LAB WORK or Case Study<br>Software Lab: Introduction to basic data analysis tools. Survey of numerical methods employed in atmospheric and related sciences: theory, application, and programming.<br>OR<br>Report on a Case study | 4 |

**Assessment:**
Internal Assessment: 40 marks
End Semester Examination: 60 Marks

**Books/References:**


1. Environmental Management: Principles and Practice, C J Barrow, Routledge Publishers London, 1999
2. A Handbook of Environmental Management Edited by Jon C. Lovett and David G.Oakwell, Edward Elgar Publishing
3. Environmental Management, V Ramachandra and Vijay Kulkarni, TERI Press
4. Indian Standard Environmental Management Systems — Requirements With Guidance For Use, Bureau of Indian Standards, February 2005
5. Environmental Management: An Indian Perspective, S N Chary and Vinod Vyasulu, Macmillan India, 2000


Adm. Y 23-24

| Course Code | Course Name | Scheme | Theory | Practical | Tutorial | Total |
|---|---|---|---|---|---|---|
| IL 384 | Maintenance of Mechanical Equipment | Contact Hours | 3 | - | - | 3 |
| | | Credits | 3 | - | - | 3 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal Assessment | | | End Sem Exam | | | | |
| | | IA 1 | IA 2 | Average | | | | | |
| IL 384 | Maintenance of Mechanical Equipment | 40 | 40 | 40 | 60 | - | - | -- | 100 |

**Lab Objectives:**

1. To understand use of different types of hand tools, importance of right tool for right job.
2. To understand .importance of preventive and breakdown maintenance,industrial safety
3. Understand assembly of lathe cross slide, spindle.
4. Understand Plumbing tools and pipe fitting minor domestic jobs.
5. To make aware about Importance of work skill in maintenance, also about related electrical, chemical activities
6. Encourage & create start up in maintenance and reconditioning field

**Outcomes:** Learner will be able to…

1. Know the use of various tools and equipment used in maintenance
2. Know, how to apply particular strategy, scheduling, planning of maintenance
3. Develop student for a start-up activity.

| Module | Detailed Contents | Hrs |
|---|---|---|
| 1 | Need and role of maintenance in industry. Preventive and breakdown/shut down maintenance.<br>Planning maintenance schedule, records, Spare parts, procuring & inventory control.<br>In house spares making. (indigenous and import substitutes)<br>Need of plant & process knowledge | 4 |
| 2 | Tools and equipment used in mechanical maintenance, (Torque wrench, Jacks and pullers<br>spanners…. etc) their classification.<br>Importance Selection of right tool for right job. Types of fits. Ball Bearings' classification<br>Study of Related electrical equipments, starter switch,, motor, contactors ...etc | 6 |
| 3 | Lathe machine functioning demonstration with, making a simple job. | 8 |
| 4 | Dismantling and assembly of cross slide, tool post.<br>Lathe spindle study | 12 |
| 5 | Domestic plumbing and other Various domestic, "Do it yourself type jobs.<br>Eg. : Window and split air conditioner periodic cleaning, ceiling fan fitting, | 6 |

Adm. Y 23-24

| | | |
|---|---|---|
| | mixer repairing,<br>curtain rod fitting on wall..etc. | |
| 6 | Industrial safety. Rules and instructions for mechanical safety in industry and safety<br>precautions related to domestic equipment.<br>Risk assessment. | 4 |

**Assessment:**
Internal Assessment: 40 marks
End Semester Examination: 60 marks

**Books/References:**


1. Maintenance Engineering – 1 December 2010 , Sushil Kumar Srivastava
2. Handbook for Mechanical Maintenance Engineers – 30 May 2020 , Gyani Mahato
3. Maintenance Engineering Dr. G.K. Vijayaraghavan, Dr. L. Govindarajan


Adm. Y 23-24

| Course Code | Course Name | Scheme | Theory | Practical | Tutorial | Total |
|---|---|---|---|---|---|---|
| IL 385 | Physical Education | Contact Hours | 3 | - | - | 3 |
| | | Credits | 3 | - | - | 3 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal Assessment | | | End Sem Exam | | | | |
| | | IA 1 | IA 2 | Average | | | | | |
| IL 385 | Physical Education | 40 | 40 | 40 | 60 | - | - | -- | 100 |

**Course Objectives:**

1. To introduce students to the fundamental concepts of physical fitness, physical activity, exercise, and wellness for lifelong health.
2. To provide knowledge of nutrition, balanced diet, energy requirements, and injury prevention related to physical training.
3. To develop understanding of wellness, weight management, BMI, waist–hip ratio, and holistic health practices.
4. To familiarize students with the structure and functions of major human body systems and the effects of exercise on them.
5. To impart foundational knowledge of yoga and meditation for stress management, emotional stability, and mental well-being.
6. To promote participation in general, recreational, and team games while understanding rules, regulations, and skill development method

**Course Outcomes**: Learner will be able to

1. Explain the concepts, components, principles, and benefits of physical fitness, exercise, and wellness.
2. Identify nutritional components, energy needs, and apply principles of balanced diet and first-aid for common sports injuries.
3. Assess wellness status using weight management methods, BMI, and waist–hip ratio for healthy living.
4. Describe the structure and functions of the cardiorespiratory, digestive, and nervous systems and analyze the effects of exercise on these systems.
5. Demonstrate basic understanding of yoga, pranayama, and meditation techniques for stress reduction and emotional balance.
6. Apply rules, regulations, and skill development methods in indoor, outdoor, recreational, and team games for fitness and recreation.

| Module | Detail Content | Hrs. |
|---|---|---|
| 1 | **Physical Fitness**<br>1.1 Concept, definition and meaning of Physical fitness, activity and exercise<br>1.2 Component of Physical fitness, Benefit of Physical fitness & exercise.<br>1.3 Principles of physical fitness<br>1.4 Definition and concept of wellness and factors affecting Physical fitness & wellness<br>1.5 Concept and importance of physical conditioning, warming up and cooling down of all age groups | 8 |

Appl. Y 23-24

| | | |
|---|---|---|
| 2 | **Nutrition and Dietary Requirement**<br>2.1 Nutrition components and balanced diet<br>2.2 Prevention and first-aid of common injuries during Physical training<br>2.3 Need of Energy, Carbohydrate and Protein | 4 |
| 3 | **Wellness, Weight management and Holistic health**<br>3.1 Meaning, concept and components of Wellness<br>3.2 Methods of weight management<br>3.3 Waist hip ratio, BMI | 4 |
| 4 | **Human body system, function and effect of exercise**<br>4.1 Meaning and Importance of the study of Human anatomy in physical education & sports<br>4.2 Structure and Effect of exercise on the cardiorespiratory system<br>4.3 Digestion and effect of exercise on the digestive system<br>4.4 Nervous system and effect of exercise on the nervous system. | 6 |
| 5 | **Yoga and meditation**<br>5.1 Concept of Yoga and misconception about Yoga<br>5.2 Meaning, Types and principles of Meditation<br>5.3 Principles governing various exercises in Yoga(Asana, Pranayam)<br>5.4 Yoga for stress management and emotional stability | 6 |
| 6 | **General & recreational troop games and its method of skill training**<br>6.1 The game soccer and its rules and regulation<br>6.2 The game Volleyball, Basketball and its rules and regulations<br>6.3 The Indoor games and their rules and regulations<br>6.4 Method of sports skill developing training<br>6.5 Recreational games and their importance in day to day life | 12 |

**Assessment:**

**1. Internal Assessment 1:Term Papers (40 Marks)**

One theory paper will be conducted for 40 marks for an hour as per the pattern of the semester-end examination will be conducted.

**2. Internal Assessment 2: Projects/Assignments(40 Marks):**

- Project on Nutrition (10 Marks): The learner will be given one project on the calculation of Basel metabolic rate. He /she will submit the report of the same in a prescribed format based on which the learner will be evaluated for 10 marks by the concerned teacher/s
- Projects/Assignment on Yoga education (10 Marks): The learner will be given an assignment on yoga education such as gathering/compiling the information about the various aspects of asanas and asking to prepare and submit the report of the same based on which the concerned subject teacher will give marks out of 10.
- Assignments on Sports Injuries (10 Marks): The learner will be given two assignments on the specific sports injuries and their remedial aspects.
- Report submitted (10 marks) in the prescribed format by him/her as well as observations.

**3. End Semester Examination (60 Marks)**

**A. MCQ (30 Marks)**

**B. Physical Activities (30 Marks):**

a. To perform 8 Asanas in a group (10)

b. To perform one Pranayama and one Kriyas(5)

c. To perform any five exercises of Motor Fitness. (5)

d. To perform any five exercises of HRPF(5)

**Reference Books:**


1. Padmakshan Padmanabhan 'Handbook of Health & Fitness', Indus Source; First edition, Indus Source Books, Wadala Mumbai. 2014.
2. Adams, William.C. 'Foundation of Physical Education Exercises and Sports Sciences', Lea and Febigor, Philadelphia, 1991.
3. Dr. Kamlesh M.L. 'Principles and History of Physical Education and Sports', Friends Publication (India) New Delhi, 2004
4. Bates M.'Health Fitness Management (2nd Ed.) USA : Human Kinetics.2008
5. Fink, H.H., Burgoon,L.A., & Mikesky. Practical Applications in Sports Nutrition. Canada : Jones and Bartlett Publishers. 2006.
6. Worthington, Vivian. History of Yoga. London : Routledge and Kegan Paul Ltd. 1982.
7. Rajan, M. Yoga Stretching and Relaxation for Sportsman. Delhi : Allied publishers. 1985.
8. Crouch James E. – Essential Human Anatomy A Text – Lea & Febriger , Philladalphia
9. Murgesh N. – Anatomy, Physiology and Health Education, Sathya, Chinnalapatti, 1990
10. Giam, C.K. Sport Medicine Exercise and Fitness. Singapore : P.G. Medical Book. 1994.


Adm. Y 23-24

| Course Code | Course Name | Scheme | Theory | Practical | Tutorial | Total |
|---|---|---|---|---|---|---|
| IL 386 | Industrial Regulations and Laws | Contact Hours | 3 | - | - | 3 |
| | | Credits | 3 | - | - | 3 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal Assessment | | | End Sem Exam | | | | |
| | | IA 1 | IA 2 | Average | | | | | |
| IL 386 | Industrial Regulations and Laws | 40 | 40 | 40 | 60 | - | - | -- | 100 |

**Course Objectives:**

1. To provide a foundation on Environmental Laws in relation to Industrial Regulations
2. To acquaint the learner about the Industrial Relations and the factors affecting it.
3. To acquaint the learner about the Trade Union system in India
4. To create an awareness on the New Industrial Policy 1991 and government schemes related to Industrialization.
5. To create awareness on the safety and welfare measures of the workmen.
6. To acquaint the learner about the social security benefits mandated by the government for workmen

**Course Outcomes: Learner will be able to**

1. Acquire conceptual and legitimate knowledge on the Environmental laws
2. Exhibit the causes of problems in Industrial Relations and the mean to resolve it.
3. Exhibit the need of Trade Union system and its challenges.
4. Exemplify the Industrial Policy 1991 and the Government schemes for Industrial development.
5. Determine the significance of the safety and welfare measures of the workmen.
6. Epitomize the various social security benefits related to the EPF and EPS, ESIC and Gratuity.

| Module | Detailed Contents | Hrs. |
|---|---|---|
| | **PART I** | |
| I | **Introduction to Environmental Laws and Industrial Regulations** | 7 |
| a | The Environment Protection Act, 1986<br>● Introduction, Concept of Vasudhaiva Kutumbakam<br>● Stockholm Conference – 1972, Objectives of Act,<br>● Bhopal Gas Tragedy<br>● Needs of Environment Protection Rules<br>● Coastal Regulation Zone Notifications (CRZ Notifications) | |
| b | The National Green Tribunal Act, 2010<br>● Introduction to NGT<br>● Objective, Structure and Powers of NGT<br>● Rio De Janerio Summit (1992)<br>● Judicial Activism in Environmental Jurisprudence<br>● Law Commission Recommendation – 2003 | |

Adm. 23-24

| | | |
|---|---|---|
| II | Industrial Relations<br>● Concept of Industrial Relations<br>● Types of Industrial Relations<br>● Characteristics, Nature and Objectives of Industrial Relations<br>● Factors Affecting Industrial Relations | 3 |
| III | Trade Union<br>● Trade Union Structure and Movement in India<br>● Phases of Trade Union Movement in India<br>● Features of Trade Union Movement<br>● Changing Role of Trade Union in Context of Liberalization<br>● Challenges faced by Trade Unions in India | 4 |
| IV | Industrial Policy<br>● Industrial Polices in India<br>● Objectives of Industrial Policies<br>● New Industrial Policy 1991<br>● Government Schemes related to Industrialization | 6 |
| | **PART 2** | |
| V | Industrial Laws | |
| a | Apprentice Act, 1961<br>● Object of the Act,<br>● Meaning of – Apprenticeship Advisor, Industry<br>● Qualification for being trained as an Apprentice<br>● Contract of apprenticeship<br>● Condition for Novation of Contract of Apprenticeship<br>● Period of Apprenticeship<br>● Payment & Termination of Apprenticeship<br>● Number of apprentices in designated trade<br>● Obligations of employers & apprentice<br>● Offence and punishment | 4 |
| b | Employees' Provident Fund & Misc. Provisions Act, 1952 & the Schemes<br>● Eligibility and Applicability of the Act<br>● Payment of Contribution<br>● Benefits and Rate of Contribution<br>● Clarification about contribution<br>● Damages<br>● Penal Provision | 3 |
| c | Employees' State Insurance Act, 1948 & the Scheme<br>● Applicability of the Act & Scheme<br>● Coverage & Rate of Contribution of the wages<br>● Manner and time limit for making payment of contribution and benefits<br>● Wages for ESI Contributions and Contribution period<br>● Penalties | 4 |

Admn 23-24

| | | |
|---|---|---|
| d | The Factories Act, 1948<br>● Applicability of the Act<br>● Employer to ensure health of workers<br>● Registration and Renewal of Factories<br>● Safety measures<br>● Welfare measures<br>● Working hours, Spread Over and Overtime<br>● Employment of Young Persons<br>● Annual Leave with wages<br>● Offences and Penalties | 4 |
| e | The Payment of Gratuity Act, 1972 and the Rules<br>● Applicability of the Act<br>● Employee covered under the Act<br>● Qualifying period<br>● Calculation of gratuity<br>● Display of Notice<br>● Nomination<br>● Recovery and Forfeiture of Gratuity<br>● Protection of Gratuity<br>● Penalties | 4 |

**Assessment:**
**Internal Assessment: 40 marks**
**End Semester Examination: 60 marks**

**Reference Books:**

1. **P. L. Malik's - Handbook of Labour and Industrial Law**
2. **N. D. Kapoor's - Handbook of Industrial Law**
3. **Dr. V. G. Goswami's - Labour and Industrial Laws**

Adm. Y 23-24

| Course Code | Course Name | Scheme | Theory | Practical | Tutorial | Total |
|---|---|---|---|---|---|---|
| IL 387 | Industrial and high voltage Safety | Contact Hours | 3 | 0 | - | 3 |
| | | Credits | 3 | 0 | - | 3 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal Assessment | | | End Sem Exam | | | | |
| | | IA 1 | IA 2 | Average | | | | | |
| IL 387 | Industrial and high voltage Safety | 40 | 40 | 40 | 60 | - | | -- | 100 |

**Course Objectives:**

1. To Promote a Safety Culture and Emergency Preparedness
2. To Develop Hazard Awareness and Risk Assessment Skills
3. To Ensure Regulatory and Standards Compliance

**Course Outcomes:** Upon successful completion of this course, learner will be able to

1. Identify, classify, and evaluate industrial hazards including mechanical, chemical, fire, and electrical/high-voltage risks
2. Perform basic hazard identification, risk assessment, and job safety analysis for typical industrial operations.
3. Analyze accident/near-miss cases and prepare structured accident investigation reports.
4. Propose suitable safeguards for machines, lifting and material handling, and energized systems.
5. Demonstrate safe work practices in high-voltage environments, including isolation, lockout–tagout, and proving dead.
6. Design an outline of a safety management and emergency response plan for a selected plant /industrial setup.

**Theory Syllabus:**

| Module | Detail Content | Hrs. |
|---|---|---|
| 1. | **Introduction to Industrial safety**<br>● Introduction to Industrial safety Management,Safety Policy & Need for safety; relationship between safety and productivity; definitions: accident, incident, injury, unsafe act/condition, dangerous occurrence, reportable accident.<br>● Accident causation theories (domino,Bird's Triangle of Accident causation, human factors); Accident Investigation and costs of accidents (direct, indirect, intangible).<br>● Safety legislation and standards: overview of Factories Act, Indian Electricity Rules (brief), IS/IEC standards, OSHA concepts. | 6 |

Asm. AY 23-24

| | | |
|---|---|---|
| 2. | **Safety management systems**<br>● Safety policy, safety organization, roles and responsibilities of management, supervisors, and workers.<br>● Safety committees, budgeting for safety, behavior-based safety, safety culture and climate.<br>● Safety training, awareness campaigns, safety audits, inspections, checklists, and performance metrics | 7 |
| 3. | **Mechanical, process and fire safety**<br>● Machine guarding: point-of-operation hazards, types of guards and safety devices, interlocks; safety in machining, grinding, welding, and cutting.<br>● Safety in material handling: manual and mechanical handling, lifting tackles, cranes, conveyors, ergonomics and musculoskeletal disorders.<br>● Process and chemical hazards (toxicity, flammability, explosions), fire triangle, classes of fire, selection and use of extinguishers, fire detection and protection systems. | 7 |
| 4. | **Basics of Electrical,HV safety and Radiation Hazard**<br>● Fundamentals of electric shock, touch and step potential, arc flash and arc blast phenomena, creepage and clearance concepts.<br>● Classification of voltage levels (LV, MV, HV), insulation systems, earthing/grounding principles and types, bonding.<br>● Regulatory and standard requirements for electrical and HV safety, signage, approach boundaries, shock and arc-flash boundaries. | 7 |
| 5. | **High voltage systems and safe work practices**<br>● HV equipment: transformers, circuit breakers , switchgear, bus bars, instrument transformers, surge arresters; typical single-line diagrams.<br>● Safe operation and maintenance of HV systems: switching procedures, interlocks, trapped-key systems, isolation and earthing, proving dead.<br>● Permit-to-work systems, lockout–tagout procedures, HV PPE (insulating gloves, mats, face shields, arc-rated clothing), safe working distances and tools. | 6 |
| 6. | **Risk assessment, emergency response, and case studies**<br>● Hazard Identification and Risk Assessment ( HAZOP outline), risk matrices, job safety analysis, control hierarchy (elimination to PPE).<br>● Emergency preparedness: on-site and off-site emergency plans, evacuation, communication, first aid for electrical shock and burns, resuscitation basics.<br>● Case studies of industrial and HV accidents, root cause analysis, lessons learned, preparation of a mini safety plan for a chosen plant | 6 |

**Theory Assessment:**

**Internal Assessment: 40 marks**

1. Consisting of One Compulsory Class Tests - 40 Marks
2. Continuous evaluation- activities/Workshops/ Assignments /Quiz/Case studies/Seminar presentation- 40 Marks

**End Semester Examination: 60 Marks**

Weightage of each module in the end semester examination will be proportional to the number of respective lecture hours mentioned in the curriculum.

Admn 25.24

**NPTEL Course completion along with certificate may be considered in lieu of End semester examination**

**Books/References:**


1. "Industrial Safety, Health and Environment Management Systems" – R. K. Jain & Sunil S. Rao, Khanna Publishers.
2. "Industrial safety management" - L.M. Deshmukh - McGraw-Hill Company
3. "Industrial Safety and Maintenance Management" – Khanna Publishers (current edition).
4. "Practical Guide to Industrial Safety: Methods for Process Safety Professionals" – Nicholas P. Cheremisinoff.
5. "Electrical Safety, Fire Safety Engineering and Safety Management" – Khanna Publishers.
6. The Cause, Effect, and Control of Accidental Loss– Ron C. McKinnon, CRC Press.
7. NFPA and IEC/IS standards for electrical and fire safety (e.g., NFPA 70E for electrical safety in the workplace).
8. Relevant Indian standards and codes (Factories Act, National Building Code safety provisions, Indian Electricity Rules – selected sections).
9. Fire Prevention Hand Book (1986) - Derek, James - Butterworths and Company, London
10. Hand Book of Fire Technology (1977) - Gupta, R.S. - Orient Longman, Bombay
11. Firefighting Principles & Practices (1991) - William E. Clark
12. Accident Prevention manual for industrial operations (1982) -N.S.C., Chicago


Adm. Y23-24

| Course Code | Course Name | Scheme | Theory | Practical | Tutorial | Total |
|---|---|---|---|---|---|---|
| IL 389 | Quantum Computing and Quantum Technologies – Part 2 | Contact Hours | 3 | 0 | - | 3 |
| | | Credits | 3 | 0 | - | 3 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal Assessment | | | End Sem Exam | | | | |
| | | IA 1 | IA 2 | Average | | | | | |
| IL 389 | Quantum Computing and Quantum Technologies – Part 2 | 40 | 40 | 40 | 60 | - | | -- | 100 |

**Course Objectives:**

1. To give a good grounding in experimental techniques relevant to Quantum Computing
2. To update students with digital circuits, RLC circuits and Vector Network Analyzer
3. Review interfacing instruments with computer and data acquisition
4. Review basics of Quantum Communication, networks and Internet
5. Overview of Quantum Materials and their importance
6. Provide some basics of band theory, magnetism, superconductivity, low dimensional materials and topological materials

**Course Outcomes:** Student will be able to learn:

1. Basic experimental techniques of RLC circuits, digital circuits and calculate quality factors
2. Fundamental techniques in RF engineering
3. Interfacing instruments with computers and data acquisition
4. Some aspects Quantum Communication, Networks and Internet
5. About Quantum Materials and connection with magnetism, superconductivity, 2-D and topological materials

Adm. AY 23-24

| Module | Detail Content | Hrs |
|---|---|---|
| 1 | **Basics of Quantum Communications:** Basics of Digital communication, Shannon entropy, Basic ideas of quantum communications, Quantum memories, Quantum networks and Quantum Internet. | 10 |
| 2 | **Basic Lab course for Quantum Tech:** RLC circuits, Digital circuits, RF Technology, VNA, Interfacing instruments with computer, Data acquisition and signal conditioning. | 13 |
| 3 | **Quantum Materials:** Introduction to materials relevant to quantum technologies. | 2 |
| 4 | **Magnetism and Superconductivity:** Basics of Magnetism, Magnetic measurements, Magnetoresistance, Hall, Faraday and Kerr effects, BCS theory of Superconductivity, Josephson Effect, Superconducting devices for quantum technologies. | 10 |
| 5 | **2-Dimensional Materials:** Properties of 2-D and topological materials | 5 |

**Assessment:**
Internal Assessment: 40 marks
End Semester Examination: 60 Marks

**Books/References:**


1. Art of Electronics, Paul Horowitz and Winfield Hill, 3rd edition, Cambridge University Press (2015)
2. Digital Design, Morris Mano, Michael D. Cilletti, 6th edition, Pearson Education (2018)
3. Microwave Engineering, David Pozar, 4th edition, Wiley (2013)
4. Discrete-time signal processing, Alan V. Oppenheim and Ronald W. Shaffer, 4th edition, Pearson (2009)
5. Quantum computation and quantum information – Nielsen and Chuang Cambridge University Press, Cambridge (2010)
6. A Pathak, Elements of Quantum Computation and Quantum Communication, Boca Raton, CRC Press (2015)
7. Condensed Matter Physics , M P Marder, 2nd Edition, John Wiley and Sons, 2010
8. Introduction to Superconductivity, Michael Tinkham, standard ed., Medtech (2017)


Adm. Y 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical /Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 392 | Project-A | -- | 04 | -- | -- | 02 | -- | 02 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | Test1 | Test 2 | Avg. of 2 Tests | | | | | |
| EC 392 | Project-A | -- | -- | -- | -- | 50 | -- | 50 | 100 |

**Lab Objectives:**

1. To offer students a glimpse into real world problems and challenges that need Engineering based Solutions
2. To enable students to create very precise specifications of the Engineering solution to be designed.
3. To introduce students to the vast array of literature available of the various research challenges in the field of Electronics and Computer Science Engineering.
4. To create awareness among the students of the characteristics of several domain areas where Electronics and Computer Science Engineering can be effectively used.
5. To enable students to use all concepts in creating a solution for a problem
6. To improve the team building, communication and management skills of the students.

**Lab Outcomes:**Student will be able to:

1. Discover potential research areas in the field of Electronics and Computer Science Engineering.
2. Conduct a survey of several available literatures in the preferred field of study
3. Compare and contrast the several existing solutions for research challenge.
4. Demonstrate an ability to work in teams and manage the conduct of the research study.
5. Formulate and propose a plan for creating a solution for the research plan identified
6. To report and present the findings of the study conducted in the preferred domain

**Guidelines:**

1. The project work is to be conducted by a group of two to four students
2. Each group will be associated with a project mentor/guide. The group should meet with the project mentor/guide periodically and record of the meetings and work discussed must be documented.
3. Department has to allocate half day for the project work in VI semester.
4. To encourage project based learning in the curriculum students may identify their technical domain area in semester VI and can perform the Mini-project in the VI semester or students may do literature survey.
5. Each group along with its guide/mentor shall identify a potential research area/problem domain, on which the study is to be conducted.

Adm. A.Y. 23-24

6. Each team will do a rigorous literature survey of the problem domain by reading and understanding at least 3-5 research papers from current good quality national/international journals/conferences.
7. (Papers selected must be indexed by Scopus/IEEE/Springer/ACM etc.). The list of papers surveyed must be clearly documented.
8. The project assessment for term work will be done at least two times at department level by giving presentation to panel members which consist of at least three (3) members as internal examiners (including the project guide/mentor) appointed by the Head of the department.
9. A report is to be prepared summarizing the findings of the literature survey. A comparative evaluation of the different techniques surveyed is also to be done.
10. Teams must analyze all the results obtained by comparing with other standard techniques.
11. Every team must publish their work in national / international conference/journals if possible (publish in Scopus indexed journals).
12. The team will finally propose a plan for project work to be continued in the final year.

**Project Assessment:**

**1.Evaluation:**

1. Each team has to give presentation/demo to the Internal Panel and External examiner.
2. Each team will prepare a report that will summarize the results of the literature survey and the project proposal. The list of papers surveyed must be clearly documented.
3. Each group will be jointly evaluated by a team of Internal and External Examiners approved by the Department of Electronics and Computer Science Engineering.
4. Oral exam will be conducted on the project done by the students.

**2.Term Work:**

Term Work shall consist of full Literature survey/ Mini-project and Presentation on above guidelines/syllabus.

**3.Oral Exam:**

An Oral exam will be held based on the Literature survey/ Mini-project and Presentation.

Adm. Y23-A

## Program Structure for
## Bachelor of Technology in Electronics & Computer Science

# Semester VII

| Course Code | Course Name | Category | Course Component | Teaching Scheme (Contact Hours) | | Credits Assigned | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | Pract/ Tuts | Theory | Pract/Tuts | Total |
| EC 401 | Image Processing & Machine Vision | PCC | T | 3 | 2 | 3 | 1 | 4 |
| EC 4xx | Department Level Optional Course IV | PEC | TL | 3 | 2 | 3 | 1 | 4 |
| EC 4xx | Department Level Optional Course V | PEC | TL | 3 | 2 | 3 | 1 | 4 |
| EC 491 | Programming Lab III (EDA) | PCC | LPC | 1 | 2 | 1 | 1 | 2 |
| EC 492 | Multidisciplinary Minor Project | MDM/ Open Elective (OE) | T | 1 | 2 | 1 | 2 | 2 |
| EC 493 | Project B | Experiential Learning Courses | LPC | - | 8 | - | 4 | 4 |
| **Total** | | | | **12** | **14** | **12** | **7** | **20** |

| Course Code | Course Name | Category | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Theory | | | | | Term Work | Pract/ Oral | Total |
| | | | Internal Assessment | | | End Sem Exam | Exam Duration (Hrs) | | | |
| | | | 1 | 2 | Avg | | | | | |
| EC 401 | Image Processing & Machine Vision | PCC | 40 | 40 | 40 | 60 | 2 | 25 | 25 | 150 |
| EC 4xx | Department Level Optional Course IV | PEC | 40 | 40 | 40 | 60 | 2 | 25 | 25 | 150 |
| EC 4xx | Department Level Optional Course V | PEC | 40 | 40 | 40 | 60 | 2 | 25 | 25 | 150 |
| EC 491 | Programming Lab III (EDA) | PCC | - | - | - | - | - | 25 | 25 | 50 |
| EC 492 | Multidisciplinary Minor Course | MDM/ Open Elective (OE) | - | - | - | - | - | 25 | 25 | 50 |
| EC 493 | Project B | Experiential Learning Courses | - | - | - | - | - | 50 | 100 | 150 |
| **Total** | | | | | | | | | | **700** |

**T- Theory , L- Lab , P-Programming, C- Communication**

Acm. Yr 23-24

| Course Code | Department Level Optional Course (DLOC) IV | Specializations |
|---|---|---|
| EC 402 | Advanced Robotics | Robotics |
| EC 403 | Advanced Network Theory | System Security |
| EC 404 | Cloud Computing | Cloud Computing |
| EC 405 | Advanced VLSI Design | VLSI Design |

| Course Code | Department Level Optional Course (DLOC) V | Specializations |
|---|---|---|
| EC 406 | Deep Learning | AIML |
| EC 407 | Data Science | Data Analytics |
| EC 408 | High Performance Computing | High Performance Computing |
| EC 409 | Internet of Everything | IOT |

Adm. Y 23-24

# Semester VIII

| Course Code | Course Name | Category | Course Component | Teaching Scheme (Contact Hours) | | Credits Assigned | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | Pract | Theory | Pract | Total |
| EC 410 | Research Methodology | Experiential Learning Courses | T | 4 | - | 4 | - | 4 |
| EC 4xx | Department Level Optional Course VI | PEC | TL | 3 | 2 | 3 | 1 | 4 |
| EC 494 | Project C | Experiential Learning Courses | LPC | - | 6 | - | 3 | 3 |
| EC 495 | Internship/ OJT | Experiential Learning Courses | LPC | - | 16 | - | 8 | 8 |
| **Total** | | | | **7** | **24** | **7** | **12** | **19** |

| Course Code | Course Name | Category | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Theory | | | | | | | |
| | | | Internal Assessment | | | End Sem Exam | Exam Duration (Hrs) | Term Work | Pract/Oral | Total |
| | | | 1 | 2 | Avg | | | | | |
| EC 410 | Research Methodology | Experiential Learning Courses | 40 | 40 | 40 | 60 | 2 | - | - | 100 |
| EC 4xx | Department Level Optional Course VI | PEC | 40 | 40 | 40 | 60 | 2 | 25 | 25 | 150 |
| EC 494 | Project C | Experiential Learning Courses | - | - | - | - | - | 50 | 50 | 100 |
| EC 495 | Internship/ OJT | Experiential Learning Courses | 50 | 50 | 50 | - | - | 50 | 100 | 200 |
| **Total** | | | | | | | | | | **550** |

**T- Theory , L- Lab , P-Programming, C- Communication**

| Course Code | Department Level Optional Course (DLOC) VI | Specializations |
|---|---|---|
| EC 411 | Intelligent Robotics | Robotics |
| EC 412 | Cyber Security & Digital Forensic | System Security |
| EC 413 | Blockchain Technology | Cloud Computing |
| EC 414 | Analog and Mixed Signal VLSI Design | VLSI Design |

Draft-Y23-24

**Program Structure for**
**Bachelor of Technology in Electronics & Computer Science**

# Bachelor of Technology In Electronics & Computer Science

# (Semester VII)

Adm. Y 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical /Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 401 | Image Processing & Machine Vision | 03 | 02 | -- | 03 | 01 | -- | 04 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | 1 | 2 | Average | | | | | |
| EC 401 | Image Processing & Machine Vision | 40 | 40 | 40 | 60 | 25 | -- | 25 | 150 |

**Course Objectives:**

1. To introduce students to the fundamental concepts and techniques of image processing.
2. To teach quality enhancement of image through filtering operations
3. To expose the students to segmentation techniques in image processing and Machine Vision
4. To teach the students image morphology and restoration techniques.
5. To teach the techniques of extracting image attributes like regions and shapes
6. To learn classification and recognition algorithms for machine vision

**Course Outcomes: Upon successful completion of the course students will be able to**

1. Develop a fundamental understanding of the basics of Image Processing.
2. Enhance the quality of image using spatial and frequency domain techniques for image enhancement
3. Learn image segmentation techniques based on principle of discontinuity and similarity using various algorithms
4. Learn image morphology and restoration techniques.
5. Represent boundaries and shapes using standard techniques.
6. Classify the object using different classification methods.

**Prerequisite:**

- Signals and Systems
- Discrete Time Signal Processing

Adm. Y 23-24

**DETAILED THEORY SYLLABUS:**

| Sr. No. | Module | Detailed Content | Hours |
|---|---|---|---|
| 1 | **Digital Image Fundamentals and Point processing techniques** | 1.1 Introduction –Steps in Digital Image Processing, concept of spatial and intensity resolution, Relationships between pixels.<br>**1.2 Point Processing :** Image Negative, Log Transform, Power Law transform, Bit plane slicing, Contrast stretching , Histogram equalization and Histogram Specification | 05 |
| 2 | **Image Enhancement** | **2.1 Spatial Domain filtering :** The Mechanics of Spatial Filtering, Smoothing Spatial Filters-Linear FiltersAveraging filter, Order-Statistic Filters-Median filter, Application of Median filtering for Noise removal Sharpening Spatial Filters- The Laplacian, Unsharp Masking and Highboost Filtering, Using First-Order Derivatives —The Gradient- Sobel, Prewitt and Roberts<br>**2.2 Frequency Domain Filtering:** Introduction to 2-D DFT and its application in frequency domain filtering, Wavelet transform, Haar transform<br>**2.3 Frequency Domain** Filtering Fundamentals, Fourier Spectrum and Phase angle ,Steps for Filtering in the Frequency Domain, Correspondence Between Filtering in the Spatial and Frequency Domains, Frequency domain Image Smoothing and sharpening filter - Ideal, Butterworth , Gaussian | 08 |
| 3 | **Image Segmentation** | 3.1 Detection of Discontinuities, edge models, Canny's edge detection algorithm , Edge linking : Local processing and boundary detection using regional processing (polygonal fitting), Hough Transform,<br>3.2 Thresholding: Foundation, Role of illumination and reflectance, Basic global thresholding Region based Segmentation, Split and Merge Techniques | 08 |
| 4 | **Morphology & Image Restoration** | 4.1 Morphology: Erosion and Dilation, Opening and Closing, The Hit- or-Miss Transformation,Boundary extraction , Hole filling, Thinning and thickening<br>4.2 Restoration: Degradation/Restoration model, noise models, estimation of degradation function by modeling,Removal periodic noise, Principle of Inverse filtering | 06 |
| 5. | **Introduction to machine vision and descriptors** | 5.1Principle of machine vision, real world applications, chain code, simple geometric border representation,Polygonal Representation, Shape Number, Moments. Fourier Transform of boundaries, Boundary description using segment sequences | 06 |

Admission 2024

| | | | |
|---|---|---|---|
| | | 5.2 Texture: Introduction to Texture, co-occurrence matrix | |
| 6 | **Machine vision Algorithms** | 6.1 Knowledge representation, Classification Principles, Classifier setting, Classifier Learning, Confusion Matrix<br>6.2 K-means clustering algorithm, Introduction, bays decision theory continuous case, two category classification, Bayesian classifier ,Support vector machine | 06 |

**DETAILED LAB SYLLABUS:**

| Sr. No. | Detailed Lab/Tutorial Description |
|---|---|
| 1 | Point Processing Methods - Negative, Log, Power law, Contrast stretching, Bit plane slicing |
| 2 | Histogram calculation and equalization |
| 3 | Spatial Domain Filtering:<br>1. Smoothening filters<br>2. Sharpening with Laplacian<br>3. Unsharp masking & high boost filtering<br>4. Edge detection using 1st and 2nd order derivatives |
| 4 | Frequency Domain Filtering : Ideal, Butterworth and Gaussian |
| 5 | Image segmentation using global Thresholding Algorithm |
| 6 | Canny edge detection |
| **7** | Shape representation using chain code |
| 8 | Morphological operation – Erosion, dilation, opening, closing, hit-miss transform, Boundary extraction |
| 9 | Feature extraction using co-occurrence matrix |
| 10 | Classification using k-means algorithm |
| 11 | Classification using Basiyan classifier |
| 12 | Basic binary classification of any data or pattern using Support Vector Machine. |
| 13 | Case Study :<br>1. Medical Image Classification using GLCM Features<br>2. Fingerprint Texture Analysis for Biometric Authentication<br>3. Fabric Defect Detection in Textile Industry |

Adm. AY 23-24

**Theory Assessments:**

**1. Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.

**2. End Sem Theory Examination:**

- Question paper will consist of 4 questions, each carrying 20 marks.
- Total 3 questions need to be solved.
- Q.1 will be compulsory, based on the entire syllabus.
- Remaining questions will be randomly selected from all the modules.
- Weightage of marks should be proportional to number of hours assigned to each module.

**Lab Assessment:**

**1. Term work Assessment:**

The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. Equal weightage should be given to laboratory experiments and while assigning term work marks.

**2. Oral/Viva Assessment:**

Practical and Oral exam will be based on the entire syllabus.

**Text Books:**


**1.** Gonzales and Woods, ―Digital Image Processing‖, Pearson Education, India, Third Edition,
**2.** Milan Sonka, Vaclav Hlavac, Roger Boyle, ―Image Processing, Analysis, and Machine Vision‖, Cengage Engineering, 3rd Edition, 2013
3. R. O. Duda and P. E. hart, Pattern classification and scene analysis, Wiley Interscience publication
4. Christopher M. Bishop; Pattern Recognition and Machine Learning, Springer, 2006


**References:**


**1.** AnilK.Jain,―Fundamentals of Image Processing‖,Prentice Hall of India,First Edition, 1989.
**2.** W Pratt, ―Digital Image Processing‖, Wiley Publication, 3rdEdition, 2002


Adm. Y 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical /Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 402 | Advanced Robotics | 03 | 02 | -- | 03 | 01 | -- | 04 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | Test1 | Test 2 | Avg. of 2 Tests | | | | | |
| EC 402 | Advanced Robotics | 40 | 40 | 40 | 60 | 25 | – | 25 | 150 |

**Prerequisite: Robotics fundamentals**

**DETAILED THEORY SYLLABUS:**

| Sr. No. | Module | Detailed Content | Hrs |
|---|---|---|---|
| 1 | **Basics of Robotic Technology** | 3.1 Robot Specifications: Axes, Capacity & Speed, Reach & Stroke, Tool Orientation, Resolution, accuracy and precision of Robot.<br>3.2 Robot Degrees of Freedom,<br>3.3 Robot Links, Joints and Symbols, Robot Coordinates, Robot Reference Frames<br>3.4 Robot Classification | 06 |
| 2 | **Mathematical Modeling of a Robot** | 2.1 Homogeneous transformation matrices,<br>2.2 Inverse transformation matrices,<br>2.3 Forward and inverse kinematic equations - position and orientation<br>2.4 Denavit-Hartenberg representation of forward kinematics, | 06 |
| 3. | **Kinematics & Dynamics of Robot** | 3.1 Direct (Forward) Kinematics: Homogeneous coordinates, Link coordinates, Coordinate frame, coordinate transform, Arm equations, An example – Four Axis SCARA.<br>3.2 Inverse Kinematics: Inverse kinematics problem, Tool Configuration, An example – Four Axis SCARA. | 06 |
| 4 | **Velocity Kinematics & Dynamics** | 4.1 Differential motions and velocities: Differential relationship, Jacobian, Differential motion of a frame and robot, Inverse Jacobian, Singularities.<br>4.2 Dynamic Analysis of Forces: Lagrangian mechanics, Newton Euler formulation,<br>4.3 Dynamic equations of two-axis robot | 07 |

AY 23-24

| | | | |
|---|---|---|---|
| 5 | **Trajectory planning** | 5.1 Path vs. Trajectory<br>5.2 Joint-Space vs. Cartesian-Space Descriptions<br>5.3 Basics of Trajectory Planning<br>5.4 Joint-Space Trajectory Planning: Third-Order Polynomial Trajectory Planning, Fifth-Order Polynomial Trajectory Planning, Linear Segments with Parabolic Blends, Linear Segments with Parabolic Blends and Via Points, Higher-Order Trajectories, Other Trajectories<br>5.5 Cartesian-Space Trajectories<br>5.6 Continuous Trajectory Recording | 07 |
| 6 | **Robotic Control** | 6.1 Basics of control systems for one-axis robots.<br>6.2 State-Space Control Methodology(one-axis robot).<br>6.3 Introduction to Controllers.<br>6.4 Design of Controllers (P, PI, PD, PID).<br>6.5 Study of LQR Controller for One Axis Robot. | 07 |

**DETAILED LAB SYLLABUS:**

**Hardware Requirements:** STM microcontroller

**Software Requirements:** Scilab, Matlab

| Sr. No. | Detailed Lab Description |
|---|---|
| 1 | Forward Kinematics of Cylindrical Robot Coordinates. |
| 2 | Forward Kinematics of 3 DOF Robots using D-H algorithm. |
| 3 | Inverse Kinematics of 2 DOF Robots |
| 4 | Inverse Kinematics of 3 DOF Robots |
| 5 | Inverse Kinematics of 3 DOF Robot Arm. |
| 6 | Trajectory using Third Order Polynomial. |
| 7 | PID Controller Tuning for Motor Control |
| 8 | Inverted Pendulum Control |
| 9 | Modeling of Mobile Robot and Manipulator |
| 10 | Mini Project |

**Theory Assessments:**

**Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with the average marks of both assessments as final score.

**End Sem Theory Examination:**

- Question paper will consist of 4 questions, each carrying 20 marks.
- Total 3 questions need to be solved.

Adm. Y 23-24

- Q.1 will be compulsory, based on the entire syllabus.
- Remaining questions will be randomly selected from all the modules.
- Weightage of marks should be proportional to number of hours assigned to each module.

**Lab Assessments:**

**1.Term work Assessment:**

At least 07 Experiments and 3 Assignments based on the entire syllabus and **one course mini project/seminar** must be submitted by a maximum batch of 2 to 3 students. Term work assessment must be based on the overall performance of the student with every experiment and Course-project is graded from time to time.

**2. Practical/Oral/Viva Assessment:** Based on the above contents and entire syllabus.

**Text Books:**

1 Saeed B. Niku, "Introduction to Robotics: Analysis, Systems,Applications",Pearson Education Inc., New DELHI, 2006

2. Schilling, Robert J. Fundamentals of robotics: analysis and control. Simon & Schuster Trade, 1996.

3. Corke, Peter I., Witold Jachimczyk, and Remo Pillat. Robotics, vision and control: fundamental algorithms in MATLAB. Vol. 73. Berlin: Springer, 2011.

**References:**

1. R Mittle, I Nagrath, "Robotics and Control", Tata Mc Graw Hill, 2017

Adm. Y 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical /Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 403 | Advanced Network Theory | 03 | 02 | -- | 03 | 01 | -- | 04 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | Test1 | Test 2 | Avg. of 2 Tests | | | | | |
| EC 403 | Advanced Network Theory | 40 | 40 | 40 | 60 | 25 | -- | 25 | 150 |

**Course Objectives:**

1. To get familiar with emerging wireless technologies.
2. To understand the basic concept of optical networking.
3. To study various WAN technologies like Frame relay and ATM.
4. To explore the basics of network design.
5. To study basic fundamentals of network security.
6. To discuss network management and control.

**Course Outcomes: Upon successful completion of the course students will be able to**

1. Get familiar with emerging wireless technologies.
2. Understand the basic concept of optical networking.
3. Study various WAN technologies like Frame relay and ATM.
4. Explore basics of network design.
5. Study the basic fundamentals of network security.
6. Discuss about network management and control

**Prerequisite:** Computer Networks

**DETAILED THEORY SYLLABUS:**

| Sr. No. | Module | Detailed Content | Hours |
|---|---|---|---|
| 1. | **Emerging Wireless Technologies** | **Wireless Personal Area Network –** Bluetooth Bluetooth (IEEE 802.15.1),Definitions of the Terms Used in Bluetooth, Bluetooth Protocol Stack, Bluetooth Link Types, Bluetooth Security, Network Connection Establishment in Bluetooth, Network Topology in Bluetooth, Bluetooth Usage Models Bluetooth Applications, WAP and Bluetooth Wireless Personal Area Networks (WPAN):Low Rate (LR) and High Rate (HR)Wireless Sensor Network, Usage of Wireless Sensor Networks, Wireless Sensor Network Model, Sensor Network | 05 |

Admy 23-24

| | | | |
|---|---|---|---|
| | | Protocol Stack, ZigBee Technology, IEEE 802.15.4 LR-WPAN Device Architecture, IEEE 802.15.3a Ultra WideBand, Radio Frequency Identification. | |
| 2. | **Optical Networking** | SONET/SDH Standards, devices, DWDM, frame format, DWDM, Performance and design considerations | 09 |
| 3. | **WAN Technologies** | **Frame:** FR concept, FR specifications, FR design and VoFR and Performance and design considerations<br>**ATM:** The WAN Protocol: Faces of ATM, ATM Protocol operations. (ATM cell and Transmission) ATM Networking basics, Theory of Operations, B-ISDN reference model, PHY layer, ATM Layer (Protocol model), ATM layer and cell<br>Traffic Descriptor and parameters, Traffic Congestion control defined, AAL Protocol model, Traffic contract and QoS, User Plane overview, Control Plane AAL, Management Plane, Sub S3 ATM,ATM public services | 08 |
| 4. | **Network Design** | Network layer design, access layer design, access network capacity, network topology and Hardware and completing the access network design | 04 |
| 5. | **Network Security** | Security threats, safeguards and design for network security<br>Enterprise Network Security: DMZ, NAT, SNAT, DNAT, Port Forwarding, Proxy, Transparent Proxy, Packet Filtering and Layer 7 Filtering | 09 |
| 6. | **Network Management and Control** | Network management definitions, functional areas (FCAPS), SNMP, RMON, Designing a network management solutions, Monitoring and control of network activity and network project management | 04 |

**DETAILED LAB SYLLABUS:**

**Software Requirements:**

1. Cisco PacketTRacer, ns 2
2. Ns-2: http://www.isi.edu/nsnam/ns/
3. Virtual Lab : http://vlab.amrita.edu/index.php?sub=78&brch=256
4. Scilab Experiments Book: https://www.google.co.in/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0ahUKEwjgwcelodTTAhVJrI8KHTQUC9AQFggqMAA&url=http%3A%2F%2Fscilab.in%2Ftextbook_companion%2Fenerate_book%2F3446&usg=AFQjCNGDs2a6AHGKL93l3_j8Ra1UN-5SQQ&sig2=yT9ep5_ZlhfRDVsv-GmsWw&cad=rja

**Online Repository Sites:**

1. Google Drive
2. GitHub
3. Code Guru

| Sr. No. | Detailed Lab Description |
|---|---|
| 1 | Study of Hardware and Software aspects of Wireless Network. |
| 2 | Study, discussion and installation of different network simulation tools such as NS2/NS3, Netstumbler, Wireshark etc. |
| 3 | Analysis of Zigbee Network to compute the energy efficiency of the network. |
| 4 | Simulation of Wireless Sensor Network (IEEE802.15.4)in NS2 or any other simulator. |

| | |
|---|---|
| 5 | To analyze the performance of DWDM. |
| 6 | To study the performance of SONET. |
| 7 | To study the performance of Frame relay. |
| 8 | To analyze the performance of ATM. |
| 9 | To configure a Network topology using packet tracer software. |
| 10 | To study Eavesdropping Attacks and its prevention using SSH. |

**Theory Assessments:**

1. **Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.
2. **End Sem Theory Examination:**
   - Question paper will consist of 4 questions, each carrying 20 marks.
   - Total 3 questions need to be solved.
   - Q.1 will be compulsory, based on the entire syllabus.
   - Remaining questions will be randomly selected from all the modules.
   - Weightage of marks should be proportional to number of hours assigned to each module.

**Lab Assessments:**

- At least 08 experiments covering entire syllabus and one mini project should be set to have well predefined inference and conclusion.
- The experiments should be students' centric and attempt should be made to make experiments more meaningful, interesting and innovative.

**1.Term work assessment:**

- Term work must be based on the overall performance of the student with every experiment graded from time to time. The grades should be converted into marks as per the Credit and Grading System manual and should be added and averaged. The grading and term work assessment should be done based on this scheme.
- The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. Practical and Oral exam will be based on the entire syllabus.
- Students are encouraged to share their experiments/mini project codes on online repository.

**2.Oral/Viva Assessment**:

Based on the above contents and entire syllabus.

**Text Books:**


1. Vijay K. Garg, "Wireless Communication and Networking", Morgan -Kaufmann
2. Series in Networking—Elsevier
3. ATM and IP Internetworking: Khalid Ahmed, John Wiley and Sons Publication.
4. Network Security and Management: Brijendra Singh, Third Edition, PHI Publication.
5. Optical network design and planning: Jane Simmons (IInd Edition), Springer Publication


**References:**


1. Theodore S. Rappaport "wireless communications - principles and practice", PEARSON Second edition.
2. Dr Sunilkumar S. Manvi, Mahabaleshwar S. Kakkasageri, "Wireless and Mobile Networks Concepts and Protocol"Wiley India Pvt Ltd.
3. T L Singal "wireless communications", Mc Graw Hill Education
4. Kazem Sohraby, Daniel Minoli, and Taieb Znati, "Wireless Sensor Networks:
5. Technology, Protocols, and Applications", Wiley Student Edition.


Adm. F 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical /Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 404 | Cloud Computing | 03 | 02 | -- | 03 | 01 | - | 04 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | Test 1 | Test 2 | Avg. of 2 Tests | | | | | |
| EC 404 | Cloud Computing | 40 | 40 | 40 | 60 | 25 | 25 | – | 150 |

**Course Objectives:**

1. To understand the Software Development Life Cycle.
2. To introduce basic concepts and shell scripting of Linux Operating Systems.
3. Basics of cloud computing.
4. Key components of Amazon Web Services.
5. To provide master skills about virtual private cloud.
6. To understand cloud security.

**Course Outcomes:**

1. Understand the basic elements and concepts related to Software Development Life Cycle
2. Illustrate the shell scripting for the various applications.
3. Define Cloud Computing and memorize the different Cloud Service and Cloud Deployment Models.
4. Describe the key components of Amazon web Service
5. Demonstrate the implementation of virtual private cloud.
6. Understand the cloud security constraints.

**Prerequisite:** Distributed systems & Networking

**DETAILED THEORY SYLLABUS:**

| Sr. No. | Module | Detailed Content | Hours |
|---|---|---|---|
| 1. | **Software Development Life Cycle (SDLC) & Process Management** | **Importance of SDLC in software development**<br>**Phases of SDLC:**<br>Requirement Gathering and Analysis, System Design, Implementation/Coding, Testing, Deployment, Maintenance and Support<br>Waterfall Model<br>Spiral Model<br>Agile Model<br>Introduction to Process management, process migration, threads, code migration. | 08 |
| 2. | **Virtual Machine & Operating System.** | Introduction to Linux, Linux Installation and Basic Commands, File system Hierarchy Standard (FHS), Users and Groups Management, Process Management, Package Management, Linux Shell Scripting, File system Administration, Functions & Operators. | 07 |
| 3. | **Introduction of Cloud Computing** | **Introduction to cloud computing:** Definition, Goals, Characteristics, Applications.<br>Cloud types: Cloud Deployment Models and Service Models (NIST, Cloud cube model),<br>Cloud computing architecture,<br>Advantages and Disadvantages of Cloud Computing. | 06 |
| 4. | **AWS Cloud Components and Storages** | **EC2:** Compute Basics, Instance types, Life cycle of instances. Amazon Machine Image (AMI). EBS: Volume Types & Features, Creation and Management, Key Management System. EFS: Features and Benefits, Architecture and Components.<br>**Simple Storage Service (S3):**<br>S3 Data Model and Storage Classes, Creating and Managing S3 Buckets, Creating and Managing S3 Buckets, S3 Object Lifecycle Management, DNS & Static Web Page Hosting | 05 |
| 5. | **Virtual Private Cloud & Load Balancer** | Subnets, Route tables, Elastic IP Addresses (EIP), Elastic Network Interfaces (ENIs), Security groups & ACL, Internet Gateway, Network Address Translation (NAT) Gateway, VPC Peering. Load Balancer, Auto Scaling. | 06 |
| 6. | **Cloud Security & Application** | Cloud Security Risks and Countermeasures, Data Protection in Cloud, Cloud Application Security, Cloud Identity and Access Management (IAM), Cloud Security as a Service, SAML, OAuth | 07 |

**DETAILED LAB SYLLABUS:**

Adm. 23-24

| Module | Detailed Lab/Tutorial Description |
|---|---|
| 1 | 1. Understanding of basic and advanced linux commands.<br>2. Linux Shell Scripting. |
| 2 | 1. Creating and AWS Account.<br>2. Launching of EC2 instance and accessing through Mobaxtrem |
| 3 | 1. Understanding of Amazon Machine Image and its sharing<br>2. EBS: Creating Snapshot & Sharing across region and account. |
| 4 | 1. Design of VPC & NAT Gateway<br>2. Management of VPC Peering and NACL |
| 5 | 1. Application of Auto Scaling Service of AWS for Managing load with different scaling policies.<br>2. Elastic Load Balancer with Auto Scaling |
| 6 | 1. Application of Simple storage service in DNS.<br>2. IAM Services of AWS. |

**Theory Assessments:**

**1. Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.

**2. End Sem Theory Examination:**

- Question paper will consist of 5 questions, each carrying 20 marks.
- Total 3 questions need to be solved.
- Q.1 will be compulsory, based on the entire syllabus.
- Remaining questions will be randomly selected from all the modules.
- Weightage of marks should be proportional to the number of hours assigned to each module.

**Lab Assessment:**

**1. Term work Assessment:**

The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. Equal weightage should be given to laboratory experiments and while assigning term work marks.

**2. Oral/Viva Assessment:**

Practical and Oral exam will be based on the entire syllabus.

**Text Books:**


1. Andrew S. Tanenbaum and Maarten Van Steen, ―Distributed Systems: Principles and Paradigms, 2nd edition, Pearson Education.
2. George Coulouris, Jean Dollimore, Tim Kindberg, , "Distributed Systems: Concepts and Design", 4th Edition, Pearson Education, 2005.
3. Barrie Sosinsky ,”Cloud Computing Bible”,Wiley Publication.


Adm. AY 23-24

4. Kailash Jayaswal, Jagannath Kallalurchi, Donald J. Houde, Dr. Deven Shah, “Cloud Computing Black Book”, Dreamtech Press.

**References:**


- A. S. Tanenbaum and M. V. Steen, "Distributed Systems: Principles and Paradigms", Second Edition, Prentice Hall, 2006.
- M. L. Liu, ―Distributed Computing Principles and Applications‖, Pearson Addison Wesley, 2004.
- Pradeep K Sinha, “Distributed Operating Systems: Concepts and design”, IEEE computer society press.
- Ajay D. Kshemkalyani,Mukesh Singhal “Distributed Computing Principles, Algorithms, and Systems”.
- Thomas Erl,Robert Cope,Amin naserpour, “Cloud Computing Design Patterns”,Pearson Publication.
- Judith Hurwitz ,”Cloud Computing for Dummies” , Wiley Publication.


Adm. Y 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical /Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 405 | Advanced VLSI Design | 03 | 02 | -- | 03 | 01 | -- | 04 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | 1 | 2 | Average | | | | | |
| EC 405 | Advanced VLSI Design | 40 | 40 | 40 | 60 | 25 | -- | 25 | 150 |

**Course Objectives:**

1. To teach various CMOS adders circuits.
2. To highlight the CMOS multiplier and shift registers design
3. To study low power CMOS circuits.
4. To teach various clocking techniques .
5. To teach different clocking techniques and data paths.
6. To highlight different interconnects and delay models.

**Course Outcomes: Upon successful completion of the course students will be able to**

1. Apply the knowledge to demonstrate various CMOS adder circuits.
2. Understand the CMOS multiplier and shift registers design.
3. Analyze and design Low power CMOS circuits.
4. Understand various clocking techniques..
5. Develop different Data path design
6. Demonstrate a clear understanding of system level design issues such as protection, timing and power dissipation

**Prerequisite:** Analog Electronics Circuits, Digital Circuits and System Design(DCSD)

**DETAILED THEORY SYLLABUS:**

| Sr. No. | Module | Detailed Content | Hrs |
|---|---|---|---|
| 1. | **Data Path Design** | **Adder:** Bit adder circuits, ripple carry adder, CLA adder, CMOS implementation of CLA adder, MODL Manchester carry chain adder, Manchester dynamic networks, carry skip adder, carry select adder, carry save adder. | 08 |

AGM-Y 23-24

| | | | |
|---|---|---|---|
| 2. | **Multipliers and shifter** | **Multipliers and shifter:** Partial-product generation, partial-product accumulation, final addition, Booth algorithm, barrel shifter | 06 |
| 3. | **Low power design** | **Low power design:** Introduction to low power VLSI design-Need for low power-Charging and Discharging Capacitance-Short Circuit Current in CMOS Circuit-CMOS leakage current-static current-Basic principles of low power design<br>Various components of power dissipation in CMOS, Limits on low power design, low power design through voltage scaling | 06 |
| 4. | **IO pads and Power Distribution:** | **IO pads and Power Distribution:** ESD protection, input circuits, output circuits, simultaneous switching noise, power distribution scheme. | 05 |
| 5. | **VLSI Clocking and System Design** | **Clocking:** CMOS clocking styles, Clock generation (single phase, two phase, four phase clocking), stabilization and distribution, Multiphase clock, H tree, Clock skew, Clock jitter | 07 |
| 6. | **VLSI interconnect design** | **Interconnect:** Interconnect delay model, interconnect scaling and crosstalk, Floor planning & routing, pin ordering - network restructuring and reorganization, Power supply droop and ground bounce. | 07 |

**DETAILED LAB SYLLABUS:** Students will have to perform experiments or write assignments on following topics.

**Software Requirements:** TINA**,** NGSpice, Microwind

| Sr. No. | Detailed Lab Description |
|---|---|
| 1 | Design of CMOS adder circuits. |
| 2 | Design of multiplier circuits. |
| 3 | Design of barrel shifter circuits. |
| 4 | ESD protection, input circuits, output circuits, |
| 5 | Switching noise, voltage droop effect in CMOS Ics. |
| 6 | Switching noise, ground bounce effect in CMOS Ics. |
| **7** | Clock generation (single phase, two phase, four phase clocking), |
| 8 | interconnect scaling and crosstalk, |

Adm. AY 23-24

**Theory Assessments:**

**1. Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.

**2. End Sem Theory Examination:**

- Question paper will consist of 4 questions, each carrying 20 marks.
- Total 3 questions need to be solved.
- Q.1 will be compulsory, based on the entire syllabus.
- Remaining questions will be randomly selected from all the modules.
- Weightage of marks should be proportional to number of hours assigned to each module.

**Lab Assessments:**

- Term work should consist of 8 experiments.
- Journal must include at least 3 assignments.

1. **Term work Assessment:**

Total 25 Marks (Experiments: 10-marks, Assignments: 10-marks, Attendance Theory & Practical: 05-marks)

2. **Oral/Viva Assessment**:

Based on the above contents and entire syllabus.

**Text Books:**


1. Sung-Mo Kang and Yusuf Leblebici, “CMOS Digital Integrated Circuits Analysis and Design”, Tata McGraw Hill, 3rd Edition.
2. Jan M. Rabaey, Anantha Chandrakasan and Borivoje Nikolic, “Digital Integrated Circuits: A Design Perspective”, Pearson Education, 2nd Edition.
3. John P. Uyemura, Introduction to VLSI circuits and systems, John Wiley & sons.


**References:**


1. Etienne Sicard and Sonia Delmas Bendhia, “Basics of CMOS Cell Design”, Tata McGraw Hill, First Edition. 2. Neil H. E. Weste, David Harris and Ayan Banerjee, “CMOS VLSI Design: A Circuits and Systems Perspective”, Pearson Education, 3rd Edition.
2. Debaprasad Das, “VLSI Design”, Oxford, 1st Edition. 6. Kaushik Roy and Sharat C. Prasad, “Low-Power CMOS VLSI Circuit Design”, Wiley, Student Edition.
3. Neil H. E. Weste , Kamran Eshraghian, Principle of CMOS VLSI Design: A system perspective, Addison Wesley publication.


Adm. Y 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical/Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 406 | Deep Learning | 03 | 02 | -- | 03 | 01 | -- | 04 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | Test1 | Test 2 | Avg. of 2 Tests | | | | | |
| EC 406 | Deep Learning | 40 | 40 | 40 | 60 | 25 | -- | 25 | 150 |

**Course Objectives:**

1. To learn the fundamentals of Neural Network.
2. To gain an insight into optimization and regularization of Deep Neural Networks
3. To acquire knowledge of advanced concepts of Convolution Neural Networks, Recurrent Neural Networks and Transformer models.
4. To investigate unsupervised deep learning models including Autoencoders, GANs, and Variational Autoencoders.
5. To Apply transfer learning principles using pre-trained models

**Course Outcomes: Upon successful completion of the course students will be able to:**

1. Gain a foundational understanding of neural networks and deep learning
2. Perform regularization, optimization and select hyperparameters for deep learning models.
3. Implement Convolutional Neural Networks (CNNs) to develop and evaluate supervised deep learning models.
4. Analyze the working of RNNs, LSTMs, and Transformers in modeling sequential and time-series data.
5. Apply the concepts of autoencoders and GANs to develop and analyze unsupervised learning models.
6. Employ transfer learning techniques using pre-trained models to develop efficient and adaptable deep learning solutions.

**Prerequisite:** Linear Algebra and Calculus**,** Probability and Statistics, Basic Biological Concepts and Machine Learning Basics

Adm Y23-24

**DETAILED THEORY SYLLABUS:**

| Sr. No. | Module | Detailed Content | Hours |
|---|---|---|---|
| 1. | **Introduction to Neural Networks and Deep Learning** | **1.1: Introduction to NN**<br>Biological Neuron. McCulloch Pitts NN, Linear Separability, Learning Rule: Perceptron, Delta.<br>**1.2: Introduction to Deep Learning**<br>ML vs DL approach, Types of DL Algorithms, Hyperparameters, Loss functions, Data augmentation, Activation functions: Sigmoid, Tanh, ReLU, Softmax. | 05 |
| 2. | **Training Deep Neural Networks: Optimization and Regularization** | **2.1: Optimization**<br>Learning with backpropagation, Learning Parameters: Gradient Descent (GD), Stochastic and Mini Batch GD, Momentum Based GD, Nesterov Accelerated GD, AdaGrad, Adam, RMSProp<br>**2.2: Regularization**<br>Overview of Overfitting, Types of biases, Bias Variance Tradeoff Regularization Methods: L1, L2 regularization, Parameter sharing, Dropout, Weight Decay, Batch normalization, Early stopping, Data Augmentation, Adding noise to input and output | 08 |
| 3. | **Convolutional Neural Networks** | **3.1: Introduction**<br>Edge Detection Filters, Filter Size, Convolutions, Padding, Stride, Compare CNN and ANN, Limitations of CNN.<br>**3.2: Architecture**<br>CNN architecture, Layers: Pooling, Convolutions. DL architecture: LeNET and AlexNET. | 07 |
| 4. | **Recurrent Neural Networks (RNNs) and Sequence Modeling** | **4.1: Introduction**<br>Recurrent neuron, RNN model, RNN types, Gradients in RNN, Back propagation, Compare CNN and RNN.<br>**4.2: Long Short Term Memory**<br>Selective Read, Selective write, Selective Forget, Gated Recurrent Unit<br>**4.3: Transformers and Attention Mechanisms:** Limitations of RNNs, Introduction to Self-Attention, Transformers, Positional Encoding, BERT/GPT Overview. | 07 |
| 5. | **Autoencoders & Generative Models** | **5.1:** Introduction, Linear Autoencoder, Undercomplete Autoencoder, Overcomplete Autoencoders, Regularization in Autoencoders.<br>**5.2:** Denoising Autoencoders, Sparse Autoencoders, Contractive Autoencoders.<br>**5.3: Generative Adversarial Network:** Discriminative vs. Generative Modeling, Architecture of GAN, Types of GANs, Variational Autoencoders (VAEs) and Introduction to Restricted Boltzmann Machines (RBMs) | 07 |
| 6. | **Transfer Learning** | **6.1 Transfer Learning Concepts:** Benefits, Scenarios, Pretrained Model, Popular Model Repositories.<br>**6.2 Customization Techniques:** Feature Extraction, Fine-tuning, Layer Freezing.<br>**6.3** Transfer Learning Implementation using VGG16 Model/ MobileNetV2/YOLO/GloVe/ ResNet50 | 05 |

AY 23-24

**DETAILED LAB SYLLABUS:**

**Lab Prerequisite:** Knowledge of Machine learning algorithms, Python Programming.

**Suggested List of Experiments:**

- Implement a single-layer perceptron for binary classification
- Implement and visualize activation functions: Sigmoid, Tanh, ReLU, Leaky ReLU, and Softmax.
- Train a basic Feedforward Neural Network using backpropagation on a small dataset (e.g., MNIST subset).
- Compare the performance of different optimizers: SGD, Adam, RMSProp, and AdaGrad.
- Apply regularization techniques such as L1, L2, dropout, and batch normalization and analyze their effects.
- Build and train a Convolutional Neural Network (CNN) on the MNIST/CIFAR-10 dataset.
- Visualize and interpret CNN layers: feature maps and filters (using matplotlib or other visualization tools).
- Implement a simple Recurrent Neural Network (RNN) for sequence prediction (e.g., character-level text generation).
- Develop an LSTM-based model for time series or sentiment analysis.
- Implement an Autoencoder for dimensionality reduction or image reconstruction.
- Train and evaluate a Generative Adversarial Network (GAN) to generate synthetic images (e.g., digits).
- Apply transfer learning using a pre-trained CNN (e.g., VGG16, ResNet50) for image classification.
- Fine-tune a pre-trained model by unfreezing layers and re-training on a custom dataset.
- Implement a basic Transformer model or use pre-trained BERT for simple NLP tasks (e.g., text classification or sentence similarity).
- Case study on any transfer learning model.

**Theory Assessments:**

**1. Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.

**2. End Sem Theory Examination:**

- Question paper will consist of 4 questions, each carrying 20 marks.
- Total 3 questions need to be solved.
- Q.1 will be compulsory, based on the entire syllabus.
- Remaining questions will be randomly selected from all the modules.
- Weightage of marks should be proportional to number of hours assigned to each module.

**Lab Assessment:**

Adm. Y23-24

1. **Termwork Assessment:** Term Work shall consist of at least 8 to 10experiments based on the above list. Also Term work Journal must include at least 2 assignments. Term Work Marks: 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance). The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.
2. **Oral/Viva Assessment:** An oral exam will be held based on the above syllabus.

**Text Books:**


1. Satish Kumar, "Neural Networks: A Classroom Approach", McGraw Hill Education; 2ed, 2017.
2. Ian Goodfellow, Yoshua Bengio and Aaron Courville, "Deep Learning", MIT Press Ltd, 2016
3. Li Deng and Dong Yu, "Deep Learning Methods and Applications", Now Publishers Inc., 2014.
4. Transfer Learning, Qiang Yang, Yu Zhang, Wenyuan Dai, SinnoJialin Pan, Cambridge University Press.
5. Neural Networks and Deep Learning: A Textbook, Charu C. Aggarwal, Springer


**References:**


1. Simon Haykin, "Neural Network - A Comprehensive Foundation", 2ed, Pearson Education, 2005.
2. S.N. Sivanandam and S.N. Deepa, "Principles of soft computing", Wiley India
3. François Chollet, "Deep learning with Python," New York: Manning, Vol. 361. 2018.
4. Douwe Osinga, "Deep Learning Cookbook", O′Reilly; 1st edition, 2018, SPD Publishers.
5. Mykel J. Kochenderfer and Tim A. Wheeler, "Algorithms for Optimization", The MIT Press, Cambridge, Massachusetts London.


Adm. Y 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical/ Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 407 | Data Science | 03 | 02 | -- | 03 | 01 | -- | 04 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | Test1 | Test 2 | Avg. of 2 Tests | | | | | |
| EC 407 | Data Science | 40 | 40 | 40 | 60 | 25 | -- | 25 | 150 |

**Course Objectives:**

1. To understand the fundamentals, lifecycle, and applications of Data Science along with data preparation techniques.
2. To learn Machine Learning techniques for developing predictive models from structured data.
3. To understand the concepts of Deep Learning and Artificial Neural Networks for data-driven applications.
4. To explore feature engineering, text analytics, and introductory deep learning techniques for unstructured data analysis.
5. To understand ethical principles, privacy regulations, and responsible practices in Data Science.
6. To study real-world applications of Data Science across various domains through case studies.

**Course Outcomes:**

After successful completion of the course students will be able to:
CO1: Demonstrate the Data Science lifecycle and data preparation techniques.
CO2: Apply Machine Learning algorithms to develop predictive models.
CO3: Develop basic Deep Learning models using Artificial Neural Networks.
CO4: Analyze text and image data using feature engineering and deep learning techniques.
CO5: Evaluate ethical and responsible practices in Data Science.
CO6: Assess Data Science applications for solving real-world problems.

**Prerequisite:** Database Management Systems (DBMS), Python Programming

Adm AY 23-24

**DETAILED THEORY SYLLABUS:**

| Sr. No. | Module | Detailed Content | Hours |
|---|---|---|---|
| 1. | **Data Science Foundations and Data Preparation** | **1.1** Introduction of AI, ML, DL & Data Science, Data Science Lifecycle, Applications of Data Science, Role of Data Scientist, **1.2** Data Acquisition, Data preprocessing, Missing Value Handling, Feature Scaling, Feature Selection, **1.3** Exploratory Data Analysis (EDA), **1.4** Introduction to Data-Centric AI | 05 |
| 2. | **Machine Learning Fundamentals** | 2.1 Supervised and Unsupervised Learning Review, Regression & Classification (Linear Regression, Logistic Regression, Multinomial Logistic Regression, Decision Trees, Naive Bays, SVM), Clustering, 2.2 Cross Validation, Bias-Variance Tradeoff, Hyperparameter Tuning, 2.3 Ensemble Learning (Random Forest overview), 2.4 Model Evaluation Metrics, 2.5 Model Deployment Concepts. | 08 |
| 3. | **Deep Learning Fundamentals for Data Science** | 3.1 Introduction to Deep Learning, Biological and Artificial Neurons, Perceptron, Multi-Layer Perceptron (MLP), 3.2 Artificial Neural Networks (ANN), 3.3 Activation Functions, 3.4 Forward and Backpropagation (Concept), Loss Functions, Data Preparation for Deep Learning, Training, Validation and Testing Datasets, 3.6 Introduction to TensorFlow/Keras. | 08 |
| 4. | **Feature Engineering, Text Analytics and Deep Learning Applications** | Feature Engineering, Feature Selection, Model Selection, Performance Metrics, Hyperparameter Tuning (Concept), Introduction to Text Analytics, Need of Text Analytics, Text Preprocessing and Cleaning, Text Representation (Bag of Words, TF-IDF), Introduction to Convolutional Neural Networks (CNN), Transfer Learning (Concept), Applications of Deep Learning in Data Science. | 08 |
| 5. | **Responsible Data Science and Ethics** | Introduction to Responsible Data Science, Data Science Ethics, Data Privacy and Security, Overview of Data Privacy Regulations (GDPR and DPDP Act), Bias and Fairness in Data Science, Informed Consent and Responsible Data Collection, Explainability and Transparency in AI Models (Concept), Ethical and Professional Practices in Data Science. | 06 |
| 6. | **Data Science Applications** | Applications of Data Science in Healthcare, Finance, Manufacturing, and Text Analytics (End-to-end data science study). Case Studies on Real-world Data Science Applications. | 04 |

**Text Books:**

1. Joel Grus, Data Science from Scratch: First Principles with Python, 2nd Edition, O'Reilly Media, 2019.
2. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras and TensorFlow, 3rd Edition, O'Reilly Media, 2023.
3. Foster Provost and Tom Fawcett, Data Science for Business, 2nd Edition, O'Reilly Media, 2023.
4. Sanjeev Wagh, Manisha Bhende and Anuradha Thakare, Fundamentals of Data Science, 2nd Edition, CRC Press / Taylor & Francis.

**References:**

1. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer.
2. Francois Chollet, Deep Learning with Python, 2nd Edition, Manning Publications, 2021.
3. Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press.
4. Bing Liu, Sentiment Analysis and Opinion Mining, Morgan & Claypool Publishers.

**DETAILED LAB SYLLABUS:**

**Suggested List of Experiments:**

- Installation and configuration of Python, Jupyter Notebook/Google Colab, and required Data Science libraries.
- Perform Data Acquisition and Exploratory Data Analysis (EDA) using NumPy and Pandas.
- Implement Data Preprocessing techniques: handling missing values, feature scaling, and feature selection.
- Implement Linear Regression for predictive analysis using Scikit-learn.
- Implement Classification using Decision Tree and Logistic Regression algorithms.
- Implement Clustering using the K-Means algorithm.
- Evaluate Machine Learning models using Confusion Matrix and Performance Metrics.
- Implement an Artificial Neural Network (ANN) using TensorFlow/Keras.
- Demonstrate Image Classification using a pre-trained CNN model (Transfer Learning).
- Perform Text Preprocessing and Feature Extraction using Bag of Words and TF-IDF techniques.
- Implement a basic Text Classification or Sentiment Analysis model using Machine Learning.
- Mini Project / Case Study based on a real-world Data Science application.

**Theory Assessments:**

1. **Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.
2. **End Sem Theory Examination:**
   - The question paper will consist of 4 questions, each carrying 20 marks.
   - Total 3 questions need to be solved.
   - Q.1 will be compulsory, based on the entire syllabus.
   - Remaining questions will be randomly selected from all the modules.
   - Weightage of marks should be proportional to number of hours assigned to each module.

**Lab Assessment:**

**1. Term Work Assessment:** Term Work shall consist of **at least 8 to 10 laboratory experiments** based on the prescribed syllabus. In addition, each student shall undertake a **mini-project or case study** involving the application of Data Science, Machine Learning, Deep Learning, solve a real-world problem and present the findings.

Adm. AY 23-24

The **Term Work Journal** shall include:

- Record of all laboratory experiments.
- At least **two assignments/tutorials** based on the course contents.
- Mini-project/case study report with presentation.

**Term Work Evaluation (25 Marks):**

- Laboratory Experiments : **15 Marks**
- Assignments / Mini-Project : **05 Marks**
- Attendance and Performance : **05 Marks**

**Total : 25 Marks**

The final certification and acceptance of the term work shall be based on the satisfactory completion of all laboratory experiments, assignments, the mini-project/case study, regular attendance, and the attainment of the minimum passing requirements prescribed by the institute.

**2. Oral/Viva Assessment:** An oral exam will be held based on the above syllabus.

Adm. Y 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical/Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 408 | High Performance Computing | 03 | 02 | - | 03 | 01 | - | 04 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | Test1 | Test 2 | Avg. of 2 Tests | | | | | |
| EC 408 | High Performance Computing | 40 | 40 | 40 | 60 | 25 | - | 25 | 150 |

**Course Objectives:**

1. To learn fundamental concepts of parallel processing
2. To learn utilization of high performance computing resources using programming Frameworks.

**Course Outcomes: Upon successful completion students will be able to**

1. Memorize and Understand classes of parallel computer architectures
2. Understand standardized, multi-platform communication methods for parallel programming
3. Understand usage of graphical processing unit hardware as high performance computing
4. Understand parallel computing implementation for a computationally intensive problem
5. Understand practical limitations of technology for high performance computing
6. Understand Power aware techniques

**Prerequisite:** Computer organization and Architectures, Parallel computing

Admy 23-24

**DETAILED THEORY SYLLABUS:**

| Sr. No. | Module | Detailed Content | Hours |
|---|---|---|---|
| 1. | **Parallel Processing Concepts** | Levels of parallelism (instruction, transaction, task, thread, memory, function), Models (SIMD, MIMD, SIMT, SPMD, Dataflow Models, Demand-driven Computation etc), Architectures: N-wide superscalar architectures, multi-core, multi-threaded | 06 |
| 2. | **Parallel Programming with CUDA** | Processor Architecture, Interconnect, Communication, Memory Organization, and Programming Models in high performance computing architectures: (Examples: IBM CELL BE, Nvidia Tesla GPU, Intel Larrabee Microarchitecture and Intel Nehalem microarchitecture), Memory hierarchy and transaction specific memory design, Thread Organization | 10 |
| 3. | **Fundamental Design Issues in Parallel Computing** | Synchronization, Scheduling, Job Allocation,JobPartitioning,Dependency Analysis, Mapping Parallel Algorithms on Parallel Architectures,Performance Analysis of Parallel Algorithms | 06 |
| 4. | **Fundamental Limitations Facing Parallel Computing** | Bandwidth Limitations,Latency Limitations, Latency Hiding/Tolerating Techniques and their limitations | 05 |
| 5. | **Power-Aware Computing and Communication** | Power-aware Processing Techniques, Power-aware Memory Design, Power-aware Interconnect Design, Software Power Management | 06 |
| 6. | **Advanced Topics** | Petascale Computing, Optics in Parallel Computing, Quantum Computers, Recent developments in Nanotechnology and its impact on HPC | 06 |

**DETAILED LAB SYLLABUS:**

**Software Requirements:**

Windows/Linux, Python, Matlab, Tensorflow

High performance Systems

| Sr. No. | Detailed Lab/Tutorial Description |
|---|---|
| 1 | Study and Write case study on your College network |
| 2 | Write program for matrix multiplication using MPI<br>Write program for matrix addition using OpenMP |
| 3 | Write program for matrix addition using CUDA |
| 4 | Write program for parallel quicksort algorithm |
| 5 | Write a program to Send message to parallel computers connected through network and find latency |

Adm. Yr. 2023-24

**Theory Assessments:**

**1. Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.

**2. End Sem Theory Examination:**

- Question paper will consist of 5 questions, each carrying 20 marks.
- Total 3 questions need to be solved.
- Q.1 will be compulsory, based on the entire syllabus.
- Remaining questions will be randomly selected from all the modules.
- Weightage of marks should be proportional to number of hours assigned to each module.

**Lab Assessment:**

**1. Term work Assessment:**

The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.

**2. Oral/Viva Assessment:**

Oral exam will be based on the entire syllabus.

**Text Books:**


1. "Highly Parallel Computing", by George S. Almasi and Alan Gottlieb
2. "Advanced Computer Architecture: Parallelism, Scalability, Programmability", by Kai Hwang, McGraw Hill 1993
3. "Parallel Computer Architecture: A hardware/Software Approach", by David Culler Jaswinder Pal Singh, Morgan Kaufmann, 1999.
4. "Scalable Parallel Computing", by Kai Hwang, McGraw Hill 1998.
5. "Introduction to Parallel Computing", Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar, 2nd edition, Addison-Welsey, © 2003.
6. "Petascale Computing: Algorithms and Applications", David A. Bader (Ed.), Chapman & Hall/CRC Computational Science Series, © 2007.


**References:**


1. GPU Gems 3 --- by Hubert Nguyen (Chapter 29 to Chapter 41)
2. "Principles and Practices on Interconnection Networks", by William James Dally and Brian Towles, Morgan Kauffman 2004.


AY 23-24

| Course Code | Course Name | Theory (Hrs) | Practical (Hrs) | Tutorial (Hrs) | Theory (Credits) | Practical/ Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 409 | Internet of Everything | 03 | 02 | -- | 03 | 01 | -- | 04 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | 1 | 2 | Avg. | | | | | |
| EC 409 | Internet of Everything | 40 | 40 | 40 | 60 | 25 | -- | 25 | 150 |

**Course Objectives:**

1. Introduce evolution of internet technology and need for IoT.
2. Discuss on IoT reference layers and various protocols and software.
3. To provide in depth knowledge in physical principles applied in sensing, measurement and a comprehensive understanding on how measurement systems are designed, calibrated, characterized, and analyzed.
4. To introduce the students to sources and detectors of various Optical sensing mechanisms and provide in-depth understanding of the principle of the basic laws and phenomena on which operation of sensor transformation of energy is based, measurement and theory of instruments and sensors.
5. Train the students to build IoT systems using sensors, single board computers and open source IoT platforms.
6. Make the students apply IoT data for business solutions in various domains in a secure manner.

Adm. AY 23-24

**Course Outcomes: Upon successful completion of the course students will be able to**

1. Identify the IoT networking components with respect to the OSI layer.
2. Build schematic for IoT solutions .
3. Design and develop IoT based sensor systems.
4. Select IoT protocols and software.
5. Evaluate the wireless technologies for IoT.
6. Appreciate the need for IoT Trust and variants of IoT and compete in the design, construction, and execution of systems for measuring physical quantities

**Prerequisite:**

Electronics Devices and Circuits(EDC), Microprocessor and Microcontroller (MPC)

**DETAILED THEORY SYLLABUS:**

| Sr. No. | Module | Detailed Content | Hours |
|---|---|---|---|
| 1 | **Introduction to Internet of Things** | Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs, Trends in the Adoption of IoT, Societal Benefits of IoT, Risks, Privacy, and Security.<br><br>Exemplary Device Boards, Arduino, Linux on Raspberry, Interface and Programming & IOT Device. Hardware Platforms and Energy Consumption, Operating Systems, Time Synchronization, Positioning and Localization, Medium Access Control, Topology and Coverage Control, Routing: Transport Protocols, Network Security, Middleware, Databases | 06 |
| 2 | **Sensing and Actuation** | Sensor fundamentals and characteristics, Optical Sources and Detectors, Intensity Polarization and Interferometric Sensors, Strain, Force, Torque and Pressure sensors, Position, Direction, Displacement and Level sensors, Velocity and Acceleration sensors, Flow, Temperature and Acoustic sensors. | 07 |
| 3 | **Networking and the Internet of Things** | IoT and Machine to Machine Communications, IoT protocols, Network configurations, Network Operator Requirements, SNMP, NETCONF, YANG, Interoperability in IoT. SDN | 08 |
| 4 | **Sensor Networks and IoT** | Characteristic and challenges, WSN vs Adhoc Networks, Sensor node architecture, Physical layer and transceiver design considerations in WSNs, Energy usage profile, Choice of modulation scheme, Dynamic modulation scaling, Antenna considerations. | 10 |

Adm. 2024

| | | | |
|---|---|---|---|
| | | Sensor Network Architecture: Data Dissemination, Flooding and Gossiping-Data gathering Sensor Network Scenarios, Optimization Goals and Figures of Merit, Design Principles for WSNs- Gateway Concepts, Need for gateway, WSN and Internet Communication, WSN Tunneling,<br><br>Amplifiers and Sensor Noise, Importance and Adoption of Smart Sensors, Architecture of Smart Sensors | |
| 5 | **Cloud Computing** | Interfacing and data logging with cloud, Evolution of Cloud Computation, Commercial clouds and their features, open source IoT platforms, cloud dashboards, Fog Computing, Introduction to big data analytics and Hadoop. | 08 |

**DETAILED LAB SYLLABUS:**

**Software Requirements:**

Arduino IDE, Noobs, Keil and energia, CCStudio

**Hardware Requirements:**

Arduino, Raspberry Pi, ARM7 Board, MSP430, Inductive transducer, Hall Effect sensor, Thermocouple, Thermistor, Temperature sensor, LCD Display, Zigbee Chip, Motors, Miscellaneous

| Sr. No. | Detailed Lab/Tutorial Description |
|---|---|
| 1 | IoT systems Working with Raspberry pi using Python. Arduino platform Working with open source clouds |
| 2 | Python Programming for IoT Systems: Basic operations, String manipulation, Dictionary, Signal plotting, processing and graphics on cloud |
| 3 | Develop a displacement measurement system with the following sensors: i. Inductive transducer (LVDT) ii. Hall effect sensor |
| 4 | After studying the characteristics of temperature sensors listed below, develop a temperature measurement system for a particular application using the suitable sensor. i. Thermocouple principles ii. Thermistor and linearization of NTC Thermistor iii. Resistance Temperature Detector iv. Semiconductor Temperature sensor OA79 v. Current output absolute temperature sensor<br><br>Based on sensing experiments carried out suggest a noncontact method and try to complete its proof of concept. |
| 5 | Embedded Programming and IoT: C programming, Declarations and Expressions, Arrays, Pointers, Constructs, Data structures and Linked list, Embedded C (Keil). |

Adm. Y 23-24

| | |
|---|---|
| 6 | Working with ARM (Keil and energia) Sub Task 1: Peripheral programming of ARM7 board Sub Task 2: PWM generation Sub Task 3:Configuring CC3200, wifi configuration ,HTTP and MQTT Protocol |
| 7 | Working with MSP430 (CCStudio) Sub Task 1: Port programming of MSP430 microcontrollers Sub Task 2: Analog to Digital Conversion using MSP430 microcontroller Sub Task 3: LCD display of characters and numbers. Sub Task 4: Timer |
| 8 | Low power wireless transmission using Zigbee Sub Task 1 : Interfacing Zigbee controller with MSP 430 microcontroller using SPI/UART. Sub Task 2: Programming sleep and wake up mode of MSP 430. |
| 9 | Speed regulation measurement of DC motor using armature control system |
| 10 | Consider a real time data available in college campus and develop a data analytic system to determine the average, trend and prediction |
| 11 | Mini Project |

**Theory Assessments:**

**1. Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.

**2. End Sem Theory Examination:**

- Question paper will consist of 5 questions, each carrying 20 marks.
- Total 3 questions need to be solved.
- Q.1 will be compulsory, based on the entire syllabus.
- Remaining questions will be randomly selected from all the modules.
- Weightage of marks should be proportional to number of hours assigned to each module.

**Lab Assessment:**

**1.Term work Assessment:**

The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. Equal weightage should be given to laboratory experiments and while assigning term work marks.

**2.Oral/Viva Assessment:**

Practical and Oral exam will be based on the entire syllabus.

**Text Books:**

Aun. Y 23-24

1. Alessandro Bassi, Martin Bauer, Martin Fiedler, Thorsten Kramp, Rob van Kranenburg, Sebastian Lange, Stefan Meissner, “Enabling things to talk – Designing IoT solutions with the IoT Architecture Reference Model”, Springer Open, 2016
2. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stamatis Karnouskos, Stefan Avesand, David Boyle, “From Machine to Machine to Internet of Things”, Elsevier Publications, 2014.
3. Jacob Fraden, “HandBook of Modern Sensors: physics, Designs and Applications”, 2015, 3rd edition, Springer, New York.
4. Jon. S. Wilson, “Sensor Technology HandBook”, 2011, 1st edition, Elsevier, Netherland.

**References:**

1. Vijay Madisetti , Arshdeep Bahga, Adrian McEwen (Author), Hakim Cassimally “Internet of Things A Hands-on-Approach” Arshdeep Bahga & Vijay Madisetti, 2014
2. LuYan, Yan Zhang, Laurence T. Yang, Huansheng Ning, The Internet of Things: From RFID to the Next-Generation Pervasive Network, Aurbach publications, March,2008.
3. RonaldL. Krutz, Russell Dean Vines,Cloud Security: A Comprehensive Guide to Secure Cloud Computing,Wiley-India, 2010.
4. John G Webster, “Measurement, Instrumentation and sensor Handbook”, 2017, 2nd edition, CRC Press, Florida.
5. Bahaa E. A. Saleh and Malvin Carl Teich, “Fundamentals of photonics”, 2012, 1st edition, John Wiley, New York.

Adm. Y 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical/ Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 491 | Programming Lab III(EDA) | 01 | 02 | -- | 1 | 1 | -- | 2 |

| Course Code | Course Name | Examination Scheme | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical/ Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | |
| | | 1 | 2 | Average | | | | |
| EC 491 | Programming Lab III(EDA) | -- | -- | -- | -- | 25 | 25 | 50 |

**Lab Prerequisite:**

Basic statistics

**Lab Objectives:**

1. Understand the concepts, workflow, and importance of Exploratory Data Analysis (EDA) in the Data Science life cycle

2. Develop the ability to acquire, clean, preprocess, and transform data using Python and R programming.

3.Apply statistical methods and feature engineering techniques to analyze datasets and extract meaningful insights.

4. Create informative visualizations and automated EDA reports using modern Python and R libraries.

5. Design interactive dashboards and Business Intelligence reports using Power BI and Tableau for effective data communication and decision-making

6. Perform end-to-end exploratory data analysis on real-world datasets while identifying data quality issues, bias, and data leakage to support machine learning applications

**Lab Outcomes:**

1: Import, inspect, preprocess, and transform structured datasets using Python (NumPy, Pandas) and R (dplyr, tidyr) correlation analysis, and dimensionality reduction, for data exploration

2. Apply descriptive and inferential statistical techniques, including hypothesis testing, ANOVA, correlation analysis, and dimensionality reduction, for data exploration.

3. Develop meaningful visualizations and automated EDA reports using Matplotlib, Seaborn, Plotly, ggplot2, ydata-profiling, and Sweetviz. 4. Code statistical functions in R.

4..Design interactive dashboards and Business Intelligence reports using Power BI and Tableau to effectively communicate analytical insights.

Adm. Y 23-24

5. Identify and address data quality issues such as missing values, outliers, duplicates, bias, and data leakage while preparing datasets for machine learning .

6.Execute an end-to-end exploratory data analysis project by integrating data preprocessing, statistical analysis, visualization, and reporting to solve real-world problems.

**DETAILED LAB SYLLABUS:**

| SN | | Detailed Lab/Tutorial Description | Hrs. |
|---|---|---|---|
| 1 | **Fundamentals of Exploratory Data Analysis** | Introduction to Data Analytics and EDA, Data Science Life Cycle, Types of Data and Variables, Data Quality, CRISP-DM Framework, EDA Workflow. | 3 |
| 2 | **Data Acquisition, Preprocessing and Transformation** | Data collection techniques, Data import, Data cleaning, Missing value treatment, Duplicate removal, Outlier detection, Data transformation, Normalization, Standardization, Encoding, Feature creation using Python and R. | 4 |
| 3 | **Statistical Analysis and Data Exploration** | Descriptive statistics, Measures of central tendency and dispersion, Correlation, Covariance, Distribution analysis, Skewness, Kurtosis, Hypothesis testing, ANOVA, Feature engineering, PCA. | 5 |
| 4 | **Exploratory Data Analysis using Python and R** | Data manipulation using NumPy, Pandas, dplyr and tidyr, Data visualization using Matplotlib, Seaborn, Plotly and ggplot2, Automated EDA using y data-profiling and Sweetviz. | 5 |
| 5 | **Data Visualization and Business Intelligence** | Data visualization principles, Statistical and interactive charts, Time-series and geographical visualization, Dashboard development using Power BI and Tableau. | 5 |
| 6 | **Advanced EDA and Case Studies** | Automated analytics, Explainable visualization, Bias and data leakage, EDA for Machine Learning, Case studies in Healthcare, Finance, Retail, Manufacturing and IoT | 4 |

Adm. AY 23-24

**List of Experiments**

**Software Requirements:**

Python, R, automated EDA tools, and Business Intelligence software

| Exp. No. | Title of Experiment |
|---|---|
| **1** | Import and Explore Datasets using Python (NumPy & Pandas) |
| **2** | Data Cleaning and Preprocessing using Pandas and R (Missing Values, Duplicates, Outliers) |
| **3** | Data Transformation and Feature Engineering using Python and R |
| **4** | Perform Descriptive Statistical Analysis using Python and R Libraries |
| **5** | Create Data Visualizations using Matplotlib, Seaborn and Plotly |
| **6** | Exploratory Data Analysis using R (dplyr, tidyr and ggplot2) |
| **7** | Automated Exploratory Data Analysis using y data-profiling and Sweetviz |
| **8** | Develop Interactive Dashboards using Power BI |
| **9** | Create Business Intelligence Dashboards using Tableau |
| **10** | Mini Project: End-to-End Exploratory Data Analysis and Visualization on a Real-World Dataset |

**Laboratory Assessment:**

**Term Work:**

Term Work shall consist of experiments on above guidelines/syllabus. Also Term work Journal must include at least 2 assignments. 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5Marks (Attendance)

**End Semester Practical/Oral Examination:**

Pair of Internal and External Examiners should conduct practical/viva based on contents. Distribution of marks for practical/viva examination shall be as follows:

**Practical Examination: 15 Marks Oral Examination: 10 Mark**

**Text Books: 1.**

1.Python for Data Analysis – Wes McKinney, 3rd Edition, O'Reilly Media, 2022.

2.R for Data Science – Hadley Wickham and Garrett Grolemund, 2nd Edition, O'Reilly Media, 2023.

3.Practical Statistics for Data Scientists – Peter Bruce, Andrew Bruce, and Peter Gedeck, 2nd Edition, O'Reilly Media, 2020.

4.Data Science from Scratch – Joel Grus, 2nd Edition, O'Reilly Media, 2019.

5.Hands-On Machine Learning with Scikit-Learn, Keras & TensorFlow – Aurélien Géron, 3rd Edition, O'Reilly Media, 2022. *(Recommended for preprocessing and EDA-related chapters.)*

Adm. y 23-24

**References:**

1. An Introduction to Statistical Learning – Gareth James, Daniela Witten, Trevor Hastie, and Robert Tibshirani (Springer)

2.Think Stats – Allen B. Downey (O'Reilly Media)

3.Data Smart – John W. Foreman (Wiley)

4.The Art of Statistics – David Spiegelhalter (Pelican Books)

5.Tableau Desktop: A Practical Guide for Business Users – Jen Stirrup (Packt Publishing)

Adm. Y 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical /Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 492 | Multidisciplinary Minor Project | 1 | 2 | -- | 1 | 1 | -- | 2 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | Test1 | Test 2 | Average | | | | | |
| EC 492 | Multidisciplinary Minor Project | -- | -- | -- | -- | 25 | -- | 25 | 50 |

**Lab Prerequisite:**

Data Structures & Algorithms, System software and Operating systems,Software Engineering and Software Testing and Quality assurance.

**Course Objectives:**

1. Apply fundamental computing and software development concepts to design and develop a software mini project.
2. Analyze and design efficient, reliable, and maintainable software solutions using appropriate algorithms and system techniques.
3. Implement Software Development Life Cycle (SDLC) phases, including analysis, design, coding, documentation, and project management.
4. Evaluate and improve software quality through testing, debugging, verification, and validation techniques.
5. Develop problem-solving, teamwork, communication, and project management skills through real-world software project development.

**Course Outcomes: Upon successful completion of the course students will be able to**

1. Apply fundamental computing concepts to design and develop a software mini project.
2. Analyze requirements and design efficient, reliable, and maintainable software solutions.
3. Implement software applications by following SDLC practices.
4. Evaluate software quality using testing, debugging, and validation techniques.
5. Demonstrate problem-solving, teamwork, communication, project management, and professional ethics in completing a software mini project.

Adm Y 23-24

**Guidelines for Mini Project**

● Students shall form a group of 2 students as it is a group activity.

● Students should do surveys and identify needs, which shall be converted into problem statements for mini projects in consultation with faculty supervisor/head of department/internal committee of faculties.

● Students shall submit an implementation plan in the form of Gantt/PERT/CPM chart, which will cover weekly activity of mini projects.

● A log book to be prepared by each group, wherein the group can record weekly work progress, guide/supervisor can verify and record notes/comments.

● Faculty supervisor may give inputs to students during mini project activity; however, focus shall be on self-learning.

● Students in a group shall understand the problem effectively, propose multiple solutions and select the best possible solution in consultation with the guide/ supervisor. Students shall convert the best solution into a working model using various components of their domain areas and demonstrate. The solution to be validated with proper justification and report to be compiled in standard format.

**Distribution of Term work marks shall be as below:-**

● Marks awarded by guide/supervisor based on log book : 10

● Marks awarded by review committee : 05

● Marks for Attendance : 05

● Quality of Project report : 05

**Oral Exam:**

Oral examination of the MiniProject should be conducted by Internal and External Examiners. Students have to give a presentation and demonstration on Project.

Adm. y 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical/ Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 491 | Project-B | -- | 08 | -- | -- | 04 | -- | 04 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | 1 | 2 | Average | | | | | |
| EC 491 | Project-B | -- | -- | -- | -- | 50 | -- | 100 | 150 |

**Course Objectives:**

1. To offer students a glimpse into real world problems and challenges that need Engineering based Solutions
2. To enable students to create very precise specifications of the Engineering solution to be designed.
3. To introduce students to the vast array of literature available of the various research challenges in the field of Electronics and Computer Science Engineering.
4. To create awareness among the students of the characteristics of several domain areas where Electronics and Computer Science Engineering can be effectively used.
5. To enable students to use all concepts in creating a solution for a problem
6. To improve the team building, communication and management skills of the students.

**Course Outcomes: Upon successful completion of the course students will be able to**

1. Discover potential research areas in the field of Electronics and Computer Science Engineering.
2. Conduct a survey of several available literatures in the preferred field of study.
3. Compare and contrast the several existing solutions for research challenges..
4. Demonstrate an ability to work in teams and manage the conduct of the research study.
5. Formulate and propose a plan for creating a solution for the research plan identified.
6. To report and present the findings of the study conducted in the preferred domain.

**Guidelines:**

1. **Project Topic:**
   - To proceed with the project work it is very important to select the right topic. The project can be undertaken on any domain of Electronics and Computer Science Engineering programme. Research and development projects on problems of practical and theoretical interest should be encouraged.
   - Project work must be carried out by the group of at least two students and maximum four and must be original.
   - Students can certainly take ideas from anywhere, but be sure that they should evolve them in the unique way to suit their project requirements.

Admn 23-24

- The project work can be undertaken in a research institute or organization/company/any business establishment.
- Students must consult an internal guide along with an external guide (if any) in selection of topic.
- The head of department and senior staff in the department will take decisions regarding selection of projects.
- Students have to submit a weekly progress report to the internal guide whereas the internal guide has to keep track of the progress of the project and also has to maintain attendance reports. This progress report can be used for awarding the term work marks.
- In case of industry projects, visits by internal guides will be preferred.

**2. Project Report Format:**

At the end of semester a project report should preferably contain at least following details:-

- Abstract
- Introduction
- Literature Survey
  a) Survey Existing system
  b) Limitation of the Existing system or research gap
  c) Problem Statement and Objective
  d) Scope
- Proposed System
  a) Analysis/Framework/ Algorithm
  b) Details of Hardware & Software
  c) Design details
  d) Methodology (your approach to solve the problem)

Implementation Plan for next semester
Conclusion
References

**3. Term Work:**

Distribution of marks for term work shall be as follows:

a) Weekly Attendance on Project Day
b) Contribution in the Project work
c) Project Report (Spiral Bound)
d) Term End Presentation (Internal)

The final certification and acceptance of TW ensures the satisfactory performance on the above aspects.

**4. Oral Exam:**

Oral examination of Project-B should be conducted by Internal and External Examiners. Students have to give a presentation and demonstration on Project- B.

Adm. Y 23-24

# Bachelor of Technology
# In
# Electronics & Computer Science

# (Semester VIII)

Adm. Y 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical/ Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 410 | Research Methodology | 4 | - | - | 4 | - | - | 4 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | 1 | 2 | Avg. | | | | | |
| EC 410 | Research Methodology | 40 | 40 | 40 | 60 | - | - | - | 100 |

**Course Objectives:**

1. To understand Research and Research Process
2. To acquaint students with identifying problems for research and develop research strategies
3. To familiarize students with the techniques of data collection, analysis of data and interpretation

**Course Outcomes:** At the end of the course learner will be able to

1. Prepare a preliminary research design for projects in their subject matter areas.
2. Accurately collect, analyse and report data.
3. Present complex data or situations clearly.
4. Review and analyse research findings.

| Module | Detail Content | Hrs. |
|---|---|---|
| 1 | **Introduction and Basic Research Concepts**<br>1.1 Research – Definition; Concept of Construct, Postulate, Proposition, Thesis, Hypothesis, Law, Principle. Philosophy and validity of research<br>1.2 Objectives of Research | 8 |

Adm. Y23-24

| | | |
|---|---|---|
| | 1.3 Characteristics of Research: Systematic, Valid, Verifiable, Empirical and Critical<br>1.4 Need of Research in Business and Social Sciences<br>1.5 Issues and Problems in Research | |
| 2 | **Types of Research**<br>2.1. Pure and Applied Research<br>2.2. Descriptive and Explanatory Research<br>2.3. Analytical Research<br>2.4 Qualitative and Quantitative Approaches<br>2.5 Literature review<br>2.6 Developing the objectives. | 8 |
| 3 | **Research Design and Sample Design**<br>3.1 Research Design – Meaning, Types and Significance<br>3.2 Sample Design – Meaning and Significance Essentials of a good sampling Stages in Sample Design Sampling methods/techniques Sampling Errors | 7 |
| 4 | **Research Methodology**<br>4.1 Meaning of Research Methodology<br>4.2. Stages in Scientific Research Process:<br>a. Identification and Selection of Research Problem<br>b. Formulation of Research Problem<br>c. Review of Literature<br>d. Formulation of Hypothesis<br>e. Formulation of research Design<br>f. Sample Design<br>g. Data Collection<br>h. Data Analysis<br>i. Hypothesis testing and Interpretation of Data<br>j. Preparation of Research Report | 8 |
| 5 | **Formulating Research Problem**<br>5.1 Considerations: Relevance, Interest, Data Availability, Choice of data, Analysis of data, Generalization and Interpretation of analysis. | 4 |
| 6 | **Outcome of Research**<br>6.1 Preparation of the report on conclusion reached.<br>6.2 Validity Testing & Ethical Issues<br>6.3 Suggestions and Recommendation<br>6.4 Identification of future scope | 4 |

Appr. y 23-24

**Assessment:**

**Internal Assessment: 40 marks**

1. Consisting of One Compulsory Class Tests of 40 Marks
2. Continuous evaluation: Class Test/ Assignments / Quiz/ Case studies/ Seminar presentation of 40 Marks

**End Semester Examination: 60 marks**

Weightage of each module in the end semester examination will be proportional to the number of respective lecture hours mentioned in the syllabus.

**Books/References:**

1. Dawson, Catherine, 2002, Practical Research Methods, New Delhi, UBS Publishers Distributors.
2. Kothari, C.R.,1985, Research Methodology-Methods and Techniques, New Delhi, Wiley Eastern Limited.

3. Kumar, Ranjit, 2005, Research Methodology-A Step-by-Step Guide for Beginners, (2nded), Singapore, Pearson Education

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical /Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 406 | Intelligent Robotics | 03 | 02 | -- | 03 | 01 | -- | 04 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | Test1 | Test 2 | Avg. of 2 Tests | | | | | |
| EC 406 | Intelligent Robotics | 40 | 40 | 40 | 60 | 25 | 25 | – | 150 |

**Prerequisite: AI, Image processing**

**DETAILED THEORY SYLLABUS:**

| Sr. No. | Module | Detailed Content | Hrs |
|---|---|---|---|
| 1 | **Image Processing and Analysis with Vision Systems** | 1.1 Image Representation,<br>1.2 Template Matching,<br>1.3 Polyhedral Objects: Edge Detection, Corner Points, Run-Length Encoding,<br>1.4 Shape Analysis: Line Descriptors, Area Descriptors Principal Angle,<br>1.5 Segmentation: Thresholding, Region Labeling<br>1.6 Iterative Processing: Shrink Operators, Swell Operators, Euler Number | 08 |
| **2** | **3D Vision and Depth Sensing** | 2.1 Pixel Coordinates, Structured Illumination<br>2.2 Light Sources, Light Patterns, Triangulation,<br>2.3 Camera Calibration<br>2.4 Stereoscopic vision and depth perception<br>2.5 Structured light and Time-of-Flight (ToF) depth sensors | 07 |

Adm. Y23-24

| | | | |
|---|---|---|---|
| | | 2.6 Depth map generation and point cloud processing<br>2.7 Applications of 3D vision in robotic manipulation and navigation | |
| 3 | **Task Planning** | 3.1 Task level programming,<br>3.2 Uncertainty,<br>3.3 Configuration Space, 3.4 Gross motion Planning, 3.5 Grasp Planning, 3.6 Fine-motion Planning, 3.7 Simulation of Planar motion, Source and goal scenes, 3.8 Task planner simulation. 3.9 Concept of motion planning. Bug Algorithms: Bug1, Bug2, Tangent Bug | 06 |
| 4 | **Robot Intelligence** | 4.1 Sensor fusion techniques<br>4.2 Localization and mapping (SLAM)<br>4.3 Object recognition and tracking<br>4.4 Introduction to AI and machine learning in robotics<br>4.5 Reinforcement learning for robotic control<br>4.6 Neural networks for perception and decision-making | 07 |
| **5** | **Human-Robot Interaction** | 3.1 Challenges and Opportunities in human-robot Interaction<br>3.2 Design principles for human-friendly robots<br>3.3 Applications of robots in collaborative settings<br>5.1 Design Principles for human-robot Interfaces<br>5.2 Collaborative Robotics<br>5.3 Ethical Considerations in Human-robot Interaction | 06 |
| **6** | **Applications** | 6.1: Industrial applications of robots, Medical, Household, Entertainment, Space, Underwater, Defense, and Disaster Management.<br>6.2 Applications, Micro and Nanorobots<br>6.3 Future Applications. | 05 |

**Theory Assessments:**

1. **Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with the average marks of both assessments as the final score.
2. **End Sem Theory Examination:**
   - Question paper will consist of 4 questions, each carrying 20 marks.
   - Total 3 questions need to be solved.
   - Q.1 will be compulsory, based on the entire syllabus.
   - Remaining questions will be randomly selected from all the modules.
   - The weightage of marks should be proportional to the number of hours assigned to each module.

**Lab Assessments:**

**1.Term work Assessment:**

**Mini project** must be submitted by a maximum of 2 to 3 students in a batch. Term work assessment must be based on the overall performance of the student with every evaluation of progress and Course-project is graded from time to time.

Adm. 2023-24

**Text Books:**

1. Saeed B. Niku, "Introduction to Robotics: Analysis, Systems,Applications",Pearson Education Inc.,New DELHI, 2006
2. Schilling, Robert J. Fundamentals of robotics: analysis and control. Simon & Schuster Trade, 1996.

**References:**


1. M.P. Groover "Industrial Robotics: Technology, Programming and Applications" Tata Mc Graw Hill Co,2001
2. Lynch, Kevin M., and Frank C. Park. Modern robotics. Cambridge University Press, 2017.
3. Corke, Peter I., Witold Jachimczyk, and Remo Pillat. Robotics, vision and control: fundamental algorithms in MATLAB. Vol. 73. Berlin: Springer, 2011.


Adm. Y 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical/Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 407 | Cyber Security and Digital Forensics | 03 | 02 | -- | 03 | 01 | -- | 04 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | Test1 | Test 2 | Avg. of 2 Tests | | | | | |
| EC 407 | Cyber Security and Digital Forensics | 40 | 40 | 40 | 60 | 25 | -- | 25 | 150 |

**Course Objectives:**

1.To understand and identify different types of cybercrime and cyber law.
2.To recognize Indian IT Act 2008 and its latest amendments.
3.To learn various types of security standards compliances
4. To discuss the need and process of digital forensics and Incident Response Methodology.
5. To explore the procedures for identification, preservation, and acquisition of digital evidence.
6. To explore techniques and tools used in digital forensics for Operating system and malware investigation

**Course Outcomes: Upon successful completion of the course students will be able to**

1. understand the concept of cybercrime and its effect on outside world
2. Interpret and apply IT law in various legal issues.
3. distinguish different aspects of cyber law.
4. understand the need and process of digital forensics and Incident Response Methodology.
5. understand the procedures for identification, preservation, and acquisition of digital evidence.

Adm. Y23-24

6. understand the techniques and tools used in digital forensics for Operating system and malware investigation

**DETAILED THEORY SYLLABUS:**

| Sr. No. | Module | Detailed Content | Hours |
|---|---|---|---|
| 1. | **Introduction to Cybercrime** | Cybercrime definition and origins of the world, Cybercrime and information security, Classifications of cybercrime, Cybercrime and the Indian ITA 2000, A global Perspective on cybercrimes | 04 |
| 2. | **Cyber offenses & Cybercrime** | How criminal plan the attacks, Social Engineering, Cyber stalking, Cyber café and Cybercrimes, Botnets, Attack vector, Cloud computing, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Devices-Related Security Issues, Organizational Security Policies and Measures in Mobile Computing Era, Laptops | 09 |
| 3. | **Tools and Methods Used in Cyberline** | Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Over Flow, Attacks on Wireless Networks, Phishing, Identity Theft (ID Theft) | 06 |
| 4. | **Introduction to Digital Forensics** | Digital Forensics Definition, Digital Forensics Goals, Digital Forensics Categories - Computer Forensics, Mobile Forensics, Network Forensics, Database Forensics Introduction to Incident - Computer Security Incident, Goals of Incident Response, CSIRT, Incident Response Methodology, Phase after detection of an incident | 08 |
| 5. | **Digital Evidence, Forensics Duplication and Digital Evidence Acquisition** | Digital evidence, Types of Digital Evidence, Challenges in acquiring Digital evidence, Admissibility of evidence, Challenges in evidence handling, Chain of Custody, Necessity of forensic duplication, Forensic image formats, Forensic duplication techniques, Acquiring Digital Evidence - Forensic Image File Format, Acquiring Volatile Memory (Live Acquisition), Acquiring Nonvolatile Memory (Static Acquisition) | 06 |
| 6. | **Forensics Investigation** | Analyzing Hard Drive Forensic Images, Analyzing RAM Forensic Image, Investigating Routers<br>Malware Analysis - Malware, Viruses, Worms, Essential skills and tools for Malware Analysis, List of Malware Analysis Tools and Techniques, Investigating logs | 06 |

Adm. Y23-24

| | | | |
|---|---|---|---|
| | | from Unix and windows systems, Investigating Windows Registry. | |

**DETAILED LAB SYLLABUS:**

**Hardware Requirements:**

Standalone desktops

**Software Requirements:**

C++

Java or equivalent compiler

| Sr. No. | Detailed Lab/Tutorial Description |
|---|---|
| 1 | To study the steps to protect your personal computer system by creating User Accounts with Passwords and types of User Accounts for safety and security. |
| 2 | Study the steps to protect a Microsoft Word Document of different version with different operating system. |
| 3 | Study various methods of protecting and securing databases. |
| 4 | Study "How to make strong passwords" and "passwords cracking techniques" using ERD Commander, Cain & able. |
| 5 | Web browser Security- Browser Security IE(Mozilla Firefox, Google Crome) Add-ons.(Firebug, WOT) |
| 6 | Cryptography using PGP and Truecrypt |
| **7** | Steganography using S-Tools and Snow |
| 8 | Email Security (Header Analysis. Email Tracker pro., Read notify) |
| 9 | Mobile Security Apps- Smart phone encryption. |
| 10 | Ethical Hacking Information Gathering Tool – Samspade (Nslookup , Whois, Tracert,) Scanning Tool(Angry IP Scanner, Nmap) |
| 11 | Protection of Information Assets using Recuva. |
| 12 | Analysis of forensic images using open source tools. ● FTK Imager ● Autopsy |
| 13 | Explore forensics tools in kali linux for acquiring, analyzing and duplicating data. ● dd ● dcfldd |
| 14 | Data Carving using open source tools<br>● Foremost<br>● Scalpel<br>● Jpegcarver |
| 15 | Performing penetration testing using Metasploit - kali Linux. |

**Theory Assessments:**

Appr. Y 23-24

**1. Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.

**2. End Sem Theory Examination:**

- Question paper will consist of 5 questions, each carrying 20 marks.
- Total 3 questions need to be solved.
- Q.1 will be compulsory, based on the entire syllabus.
- Remaining questions will be randomly selected from all the modules.
- Weightage of marks should be proportional to number of hours assigned to each module.

**Lab Assessment:**

**1. Term work Assessment:**

At least 6 experiments covering the entire syllabus of DCSD should be set to have well predefined inference and conclusion. The experiments should be student centric and attempt should be made to make experiments more meaningful, interesting. Simulation experiments are also encouraged. Experiments must be graded from time to time. The grading and term work assessment should be done based on this scheme. The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. Practical and Oral exam will be based on the entire syllabus. Equal weightage should be given to laboratory experiments and while assigning term work marks.

**2. Oral/Viva Assessment:**

The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. Practical and Oral exam will be based on the entire syllabus.

**Text Books:**

1. Nina Godbole, SunitBelapure, Cyber Security, Wiley India, New Delhi
2. The Indian Cyber Law by Suresh T. Vishwanathan, Bharat Law House New Delhi
3. The Information technology Act, 2000; Bare Act- Professional Book Publishers, New Delhi.
4. Cyber Law & Cyber Crimes By Advocate Prashant Mali; Snow White Publications, Mumbai
5. Nina Godbole, Information Systems Security, Wiley India, New Delhi

**References:**

1. Kennetch J. Knapp, Cyber Security &Global Information Assurance Information Science Publishing.
2. William Stallings, Cryptography and Network Security, Pearson Publication
3. Websites for more information is available on: The Information Technology ACT, 2008- TIFR: https://www.tifrh.res.in

Adm. Y 23-24

| Course Code | Course Name | Theory (Hrs) | Practical (Hrs) | Tutorial (Hrs) | Theory (Credits) | Practical /Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 408 | Blockchain Technology | 03 | 02 | -- | 03 | 01 | -- | 04 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | Test 1 | Test 2 | Avg. of 2 Tests | | | | | |
| EC 408 | Blockchain Technology | 40 | 40 | 40 | 60 | 25 | -- | 25 | 150 |

**Course Objectives:**

1. To understand basics of Blockchain technology
2. To understand concept of cryptocurrency and Bitcoin
3. To understand concepts of Ethereum Blockchain
4. To learn the concepts of Hyperledger
5. To understand solidity programming language and concepts of smart contracts
6. To learn and develop various applications of Blockchain

**Course Outcomes: Upon successful completion of the course students will be able to**

1. Have an understanding and working knowledge of the emerging blockchain technology.
2. Discuss concept of cryptocurrency and Bitcoin
3. Apply the knowledge of Ethereum Blockchain
4. Understand and analyze the working of Hyperledger
5. Explore basics of solidity programming language and smart contracts
6. Develop various applications of Blockchain

**Prerequisite:** Data Structure and Algorithm, Computer Networks

Adm Y 23-24

**DETAILED THEORY SYLLABUS:**

| Sr. No. | Module | Detailed Content | Hours |
|---|---|---|---|
| 1 | **Introduction of Cryptography and Blockchain** | What is Blockchain, Blockchain Technology Mechanisms & Networks, Blockchain Origins, Objective of Blockchain, Blockchain Challenges, Transactions And Blocks, P2P Systems, Keys As Identity, Digital Signatures, Hashing, and public key cryptosystems, private vs. public Blockchain | **07** |
| 2 | **Bitcoin and Cryptocurrency** | What is Bitcoin, Bitcoin Network, Bitcoin Mining Process, Mining Developments, Bitcoin Wallets, Hot and Cold Storage, Decentralization and Hard Forks, Merkle Tree, Double-Spend Problem, Blockchain and Digital Currency, Transactional Blocks, Impact of Blockchain Technology on Cryptocurrency | **08** |
| 3 | **Introduction to Ethereum Blockchain** | Introduction to Ethereum, Ethereum Structure,Ethereum Operations, Ethereum Virtual Machine (EVM), Incentive Model, Consensus Mechanisms, How Smart Contracts Work, Metamask Setup, Ethereum Accounts, Initial Coin Offering(ICO) | **07** |
| 4 | **Introduction to Hyperledger** | What is Hyperledger? , Distributed Ledger Technology & its Challenges,Hyperledger: Distributed Ledger Frameworks and Domain Specific Blockchains, Hyperledger Fabric, Hyperledger Fabric Architecture, Hyperledger Composer. | **05** |
| 5 | **Solidity Programming Language** | Solidity -Language of Smart Contracts, Installing Solidity & Ethereum Wallet, Basics of Solidity, Layout of a Solidity Source File & Structure of Smart Contracts, General Value Types (Int, Real, String, Bytes, Arrays, Mapping, Decision making, Structs ,Ether units, Enum, address, special variables), Solidity Functions , Solidity patterns (pattern withdrawal and restricted access) | **08** |
| 6 | **Blockchain Applications** | Blockchain Applications: Internet of Things, Medical Record Management System, Do-main Name Service and future of Blockchain | **04** |

Adm. Y-23-24

**DETAILED LAB SYLLABUS:**

**Software Requirements:** Remix Browser - online compiler

| Sr. No. | Detailed Lab Description |
|---|---|
| 1 | Understanding the concept of Hash in Blockchain |
| 2 | Working of Bitcoin mining and how blocks are added in the Blockchain. |
| 3 | Setting up bitcoin wallet |
| 4 | Creating and Building Up Crypto Token |
| 5 | Setting up Metamask and MIST Wallet |
| 6 | Set up Hyperledger Fabric Blockchain using Hyperledger Composer locally |
| 7 | Create a smart contract for Hotel Room |
| 8 | Create a smart contract for voting system |
| 9 | Create a smart contract that implements the simplest form of a cryptocurrency.<br>The contract allows only its creator to create new coins (different issuance schemes are possible). Anyone can send coins to each other without a need for registering with a username and password, all you need is an Ethereum keypair |
| 10 | Simple Open Auction Smart Contract<br>The general idea of the following simple auction contract is that everyone can send their bids during a bidding period. The bids already include sending money / Ether in order to bind the bidders to their bid. If the highest bid is raised, the previous highest bidder gets their money back. After the end of the bidding period, the contract has to be called manually for the beneficiary to receive their money - contracts cannot activate themselves. |
| 11 | Practical use cases of Blockchain - Case study |

**Theory Assessments:**

1. **Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.
2. **End Sem Theory Examination:**

- Question paper will consist of 5 questions, each carrying 20 marks.
- Total 3 questions need to be solved.
- Q.1 will be compulsory, based on the entire syllabus.

Adm. Y 23-24

- Remaining questions will be randomly selected from all the modules.
- Weightage of marks should be proportional to number of hours assigned to each module.

**Lab Assessment:**

1. **Term work Assessment:**

The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. Equal weightage should be given to laboratory experiments and while assigning term work marks.

2. **Oral/Viva Assessment:** Practical and Oral exam will be based on the entire syllabus.

**Text Book**

1.Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016).
2.Arshdeep Bahga, Vijay Madisetti, Blockchain Applications: A Hands-On Approach Paperback, VPT; 1st edition (31 January 2017)
3.Baset, Salman A., Blockchain Development with Hyperledger,Packt, 2019
4. Parikshit Jain, A Practical Guide To Blockchain And Its Applications, Bloomsbury India,1st Edition,February 2019

**Reference Books**

1.Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies
2.Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System
3.DR. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger,"Yellow paper.2014.
4.Nicola Atzei, Massimo Bartoletti, and Tiziana Cimoli, A survey of attacks on Ethereum smart contracts
5.Jitendra Chittoda, Mastering Blockchain Programming with Solidity: Write production-ready smart contracts for Ethereum blockchain with Solidity,Packt Publishing; 1st edition (2 August 2019).

Adm. Y 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical/ Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 409 | Analog and Mixed Signal VLSI Design | 03 | 02 | -- | 03 | 01 | -- | 04 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | Test1 | Test 2 | Avg. of 2 Tests | | | | | |
| EC 409 | Analog and Mixed Signal VLSI Design | 40 | 40 | 40 | 60 | 25 | -- | 25 | 150 |

**Course Objectives:**

1. To teach analysis and design of building blocks of CMOS Analog VLSI Circuits.
2. To highlight the issues associated with the CMOS analog VLSI circuit design.
3. To emphasize upon the issues related to MOS Amplifier.
4. To emphasize upon the issues related to oscillators and PLL.
5. To emphasize upon the issues related to mixed signal layout design.
6. To highlight the issues associated with data Converter

**Course Outcomes: Upon successful completion of the course students will be able to**

1. Discuss tradeoffs involved in analog VLSI Circuits.
2. Analyze amplifier fundamentals.
3. Discuss various MOS operational amplifier.
4. Analyze building blocks of CMOS analog VLSI circuits.
5. Design building blocks of CMOS analog VLSI circuits
6. Carry out verifications of issues involved in analog and mixed signal circuits.

**Prerequisite:**Electronic Devices and Circuits I, Digital Circuit Design, Electronic Devices and Circuits II, Design With Linear Integrated Circuits, VLSI Design, VLSI Design

Adm. Y 23-24

**DETAILED THEORY SYLLABUS:**

| Sr. No. | Module | Detailed Content | Hours |
|---|---|---|---|
| 1. | **Analog building blocks** | Need for CMOS analog and mixed signal designs, MOS Transistor assampling switch, active resistances, current source and sinks,current mirror.<br>Voltage References: Band Gap References, General Considerations, Supply-independent biasing, Temperature independent references, PTAT, current generation and Constant Gm biasing. | 08 |
| 2. | **Amplifier Fundamentals** | Single Stage Amplifiers: Basic concepts, Gain Bandwidth (GBW),<br>Common-source stage (with resistive load, diode connected load, current-<br>source load, triode load, source degeneration), source follower, common-gate stage, cascode stage, folded cascade stage.<br>Differential Amplifiers: Single ended and differential operation, Basic differential pair, large signal and small signal behaviours, Common-mode<br>response, Differential pair with MOS loads.<br>Noise: Statistical Characteristics of Noise, Types of Noise, Representation of Noise in circuits, Noise in Single stage amplifiers (CS, CD, CG stages), noise in differential pairs, noise bandwidth, noise figure, noise temperature. | 07 |
| 3. | **MOS Operational Amplifiers** | Stability and Frequency Compensation: General Considerations, Multipole systems, Phase margin, Frequency compensation, compensation of two stage op-amps.<br>Op-amp Design: General Considerations, performance parameters, One- stage op- amps, Two-stage op-amps, Gain Boosting, Common-mode feedback, Input range limitations(ICMR), Slew Rate, Power supply rejection, Noise in op-amps. Design of single ended and double ended two stage Op-amps. | 07 |
| 4. | **Mixed Signal Circuits** | Basic Concepts: AMS design flow, ASIC, Full custom design, Semi- custom design, System on Chip, System in package, Hardware software co-design, and mixed signal layout issues.<br>Oscillators: General considerations, Ring oscillators, LC oscillators, VCO. | 06 |

Admit 23-24

| | | | |
|---|---|---|---|
| | | Phase-Locked Loop: Simple PLL, Charge pump PLL, Non-ideal effects in PLL, Delay locked loops and applications of PLL in integrated circuits. | |
| 5. | **Data Converter Fundamentals** | Switch Capacitor Circuits: MOSFETs as switches, Speed considerations,<br>Precision Considerations, Charge injection cancellation, Unity gain buffer,<br>Non- inverting amplifier and integrator.<br>Basic CMOS comparator Design, Adaptive biasing, Analog multipliers. | 06 |
| 6. | **Data Converter Fundamentals and Architectures** | Fundamentals: Analog versus discrete time signals, converting analog signals to data signals, sample and hold characteristics. DAC specifications, ADC specifications.<br>DAC architectures: Digital input code, resistors string, R-2R ladder networks, current steering, charge scaling DACs, Cyclic DAC, pipeline DAC<br>ADC architectures: Flash, Two Step Flash, Pipeline ADC, Integrating ADCs, Successiveapproximation ADCs. | 05 |

**DETAILED LAB SYLLABUS:**
**Software Requirements:** LT Spice

| Sr. No. | Detailed Lab/Tutorial Description |
|---|---|
| 1 | Design and Simulate NMOS Inverter with Resistive load. Plot Drain current and Trans conductance. |
| 2 | Design and simulate NMOS current Mirror and plot Iref. |
| 3 | Design and simulate CS amplifier. With and without source degeneration . |
| 4 | Design and simulate Cascode Current Mirror Circuit. |
| 5 | Design and simulate basic Differential Amplifier Circuit. |
| 6 | Design and simulate one stage Op-Amp circuit. |
| **7** | Design and simulate Sample and Hold circuit. |
| 8 | To design of simulate 3 stage ring oscillator. |
| 9 | Case study of IEEE papers. |
| 10 | Case study of IEEE papers. |

**Theory Assessments:**

**1. Internal Assessment:** Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.

Adm. AY 23-24

**2. End Sem Theory Examination:**

- Question paper will consist of 5 questions, each carrying 20 marks.
- Total 3 questions need to be solved.
- Q.1 will be compulsory, based on the entire syllabus.
- Remaining questions will be randomly selected from all the modules.
- Weightage of marks should be proportional to number of hours assigned to each module.

**Lab Assessment:**

**1. Term work Assessment:**

The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.

**2. Oral/Viva Assessment:**

Practical and Oral exam will be based on the entire syllabus.

**Text Books:**


1. B Razavi, "Design of Analog CMOS Integrated Circuits", Tata McGraw Hill, 1st Edition.
2. R. Jacaob Baker, Harry W. Li, David E. Boyce, "CMOS Circuit Design, Layout, and Simulation", Wiley, Student Edition
3. P. E. Allen and D. R. Holberg, "CMOS Analog Circuit Design", Oxford University Press, 3rd Edition.
4. Gray, Meyer, Lewis, Hurst, "Analysis and design of Analog Integrated Circuits", Willey, 5th Edition.


**References:**


1. Jean-Pierre Colinge, "FinFETs and Other Multigate Transistors", Springer, 1st edition
2. M. S. Tyagi, "Introduction to Semiconductor Materials and Devices", John Wiley and Sons,1st edition.
3. James E. Morris and KrzysztolIniewski, "Nanoelectronic Device ApplicationsHandbook", CRCPress.
4. Glenn R. Blackwell, "The electronic packaging", CRC Press.
5. Michael L. Bushnell and Vishwani D. Agrawal, "Essentials of Electronic Testing fordigital, memory and mixed-signal VLSI circuits", Springer.


Aqm. Y 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical /Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 492 | Project C | -- | 6 | -- | -- | 3 | -- | 3 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | Test1 | Test 2 | Average | | | | | |
| EC 492 | Project C | -- | -- | -- | -- | 50 | -- | 50 | 100 |

**Course Objectives:**

1. To offer students a glimpse into real world problems and challenges that need Engineering based Solutions
2. To enable students to create very precise specifications of the Engineering solution to be designed.
3. To introduce students to the vast array of literature available of the various research challenges in the field of Electronics and Computer Science Engineering.
4. To create awareness among the students of the characteristics of several domain areas where Electronics and Computer Science Engineering can be effectively used.
5. To enable students to use all concepts in creating a solution for a problem
6. To improve the team building, communication and management skills of the students.

**Course Outcomes:**

1. Discover potential research areas in the field of Electronics and Computer Science Engineering.
2. Conduct a survey of several available literatures in the preferred field of study
3. Compare and contrast the several existing solutions for research challenge
4. Demonstrate an ability to work in teams and manage the conduct of the research study.
5. Formulate and propose a plan for creating a solution for the research plan identified
6. To report and present the findings of the study conducted in the preferred domain

**Lab Assessment:**

**Guidelines:**
**1. Project Report Format:**

Adm. Y 23-24

At the end of the semester the student needs to prepare a project report which should be prepared as per the guidelines issued by the ECS Department. Along with the project report a CD containing: project documentation, Implementation code, required utilities, Software‘s and user Manuals need to be attached.

**2. Term Work:**
Students have to submit a weekly progress report to the internal guide and the internal guide has to keep a track on the progress of the project and also has to maintain the attendance report. This progress report can be used for awarding the term work marks. In case of industry projects, visits by internal guide will be preferred to get the status of the project. Distribution of marks for term work shall be as follows:
a) Weekly Attendance on Project Day
b) Project work contributions as per objective
c) Project Report (Hard Bound)
d) Term End Presentation (Internal)

The final certification and acceptance of TW ensures the satisfactory performance on the above aspects.

**3. Oral Exam:**
Oral examination of Project-C should be conducted by Internal and External Examiners. Students have to give a presentation and demonstration on the Project- C.

Adm. Y 23-24

| Course Code | Course Name | Theory (Hrs.) | Practical (Hrs.) | Tutorial (Hrs.) | Theory (Credits) | Practical /Oral (Credits) | Tutorial (Credits) | Total (Credits) |
|---|---|---|---|---|---|---|---|---|
| EC 493 | Internship | - | 16 | - | - | 8 | - | 8 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | IA1 | IA2 | Avg | | | | | |
| EC 493 | Internship | - | - | - | - | 100 | - | 100 | 200 |

**Course Description:**
Provides the student with an opportunity to gain knowledge and skills from a planned work experience in the student's chosen career field. Internships or placements are directly related to the student's program of study and provide learning experiences not available in the classroom setting. Internships provide entry-level, career-related experience, and workplace competencies that employers value when hiring new employees. Internships may also be used as an opportunity to explore career fields.

**1. Course Objectives:** The course is aimed:

1. To provide an opportunity to apply theoretical knowledge and skills into practice.
2. To offer firsthand experience with cutting-edge technologies utilized in industry, research labs, and startup environments.
3. To develop networking with professionals while learning new skills.
4. To familiarize students with the code of conduct, organizational work ethics and environment.

**2. Course Outcomes:** On successful completion of the course learner/student will be able to:

1. Gain exposure to real-world organizational scenarios and attain hands-on experience within a professional setting.
2. Develop expertise in various business or industry skills relevant to the internship or placement field.
3. Enhance professional communication skills through written, verbal, and non-verbal methods.
4. Refine and clarify professional and career goals through critical analysis of the internship experience.
5. Recognize their individual educational requirements to stay competent in an evolving world.
6. Acquire the capability to function effectively as a team member or leader.

**3. Guidelines regarding Internship:**

1. To get hands-on experience of the real world, every candidate is required to undertake an individual internship in an organization of repute. The duration of the Internship will be a

Appr. Y 23-24

minimum of 14 weeks to a maximum of 20 weeks.

2. The internship duration/slot will start immediately after completion of semester VII examinations and it will end on the last instructional date of semester VIII (as per the academic calendar).
3. All students enrolled in semester VII must submit the Application Form in the prescribed format to the Internship Cell/Internship Coordinator at least a month before the last instructional day of semester VII.
4. Students shall submit an implementation plan in the form of a Gantt/PERT/CPM chart, which will cover the weekly activity of the internship.
5. In the case of an internship offered through the college selection process, the student is eligible for only one offer and cannot appear for further processes once selected.
6. The applications will be scrutinized by the internship approval committee at the college/department level for their merit. The decision of the committee will be final and further grievances will not be entertained.

    a. The college will assign a mentor for each student who will monitor the student's progress throughout the internship. The students are expected to be in contact with the mentor on a regular basis.
    b. Students can join an internship only after getting an approval from the internship-committee.
    c. In case any student attempts to join an internship bypassing college procedure, it will not be considered for credit completion of semester VIII and hence for award of the B.Tech degree.

7. Faculty Internship Advisor or Internship Education Program Advisor may give input to students during an internship, however, the focus shall be on self-learning by the student.
8. A log book is to be prepared by each student, wherein students can record weekly work progress; faculty Internship Advisor can verify and record notes/comments.
9. Students should make an Internship report as per the format provided.

**4. Suggested Internships Categories:** The following are the suggested categories of valid Internships:

1. Industrial Internship – Private, Public, LLP or Start-up company.
2. Incubation center – Under start-up or pre-incubation registered with Incubation center, Innovation / Entrepreneurship related activities.
3. Government Sector – BSNL, BEL, BHEL, ONGC, GMRT, Railways, etc.
4. Government Research organization – IIT, NIT's, IITM, IISR, DIAT, ISRO, TIFR, etc.
5. Research lab – NCL, CSIR, CME, CPR, HEMRL, DRDO, Police Research Centre, etc.
6. Institutional Internship through UGROP.
7. Internships other than UG project work offered by PI/CoPI of any Research project, live Industry projects, different technical activity clubs, learning at departmental Lab/Tinkering Lab/Institutional workshop, etc.

**5. Internship Attendance Guidelines:**

1. Students are required to report to work on time and must adhere to the requirements outlined in their individualized work schedule.
2. Students are required to follow the attendance policies set by the employer and are expected to inform the Faculty Internship Advisor in case of any absence from work.
3. Students are expected to adhere to their work schedule and report to work even when the

employer has reduced daily hours.

**6. Internship Report Format:**

At the end of the semester, the Internship report should preferably contain at least the following details:

**1. Introduction**
- 1.1 About the Organization
- 1.2 About the Internship
- 1.3 Purpose of Internship
- 1.4 Scope and Objectives of Internship
- 1.5 Roles and Responsibility
- 1.6 Organization of the Internship Report

**2. Internship Activities**
- 2.1 Responsibilities and Tasks Assigned
- 2.2 Weekly Overview of Internship Activities
- 2.3 Work Accomplishments
- 2.4 Details of Work Carried Out and its Evidence
- 2.5 Challenges Faced
- 2.6 Achievements and Benefits to the Company/Society

**3. Learning through Internship**
- 3.1 Technology & Tools Used
- 3.2 Methodology Adopted
- 3.3 Skills Acquired/Enhanced

**4. Conclusion**
- 4.1 Summary of Key Points
- 4.2 Overall Internship Experience

**Bibliography**

**7. Internship Evaluation Guidelines:**

The institute shall ask the Internship offering Organization to allocate a mentor to the students to monitor and update the progress of the student and undertake groundwork to make the internship more effective. The institute (concerned department) will allocate an internal faculty mentor to the students. The faculty mentor will undertake a continuous evaluation of the students and will be responsible for the submission of his/her grades. The interactions may be through Email/Skype/Video Conferencing, etc., or a personal visit by a faculty mentor to the internship site, as the need be or the policy of the institute. The student needs to submit the internship joining report duly signed by the mentor from the organization and the mentor from the institute to the department within two weeks from the commencement of the internship.

**Suggested distribution of Term Work of 100 marks for internship shall be awarded based on:**

**A. Average of Two Internal mock assessment: 50 marks**

Which includes:
a. Attendance: **15 Marks**
b. Weekly log report: **15 Marks**
c. Presentation (as per defined rubrics/parameters): **20 Marks**

**B.** Quality of internship report: **30 marks**

Acad. Y 23-24

C. Quality of work carried out during Internship and presentation: **20 marks**

**C. Suggested distribution of Oral/Practical of 100 marks for internship shall be awarded based on:**

- Evaluation/Feedback by industry/employer and final presentation: **30 marks**
- Evidence and demonstration of learning: **10 Marks**
- Depth of knowledge, technology used and skills acquired during Internship: **20 marks**
- Quality of work carried out, achievements and benefits to the company/society: **20 marks**
- Effectiveness of presentation and response to question(s): **20 marks**

**Links for Internship Documents:**

1. Weekly log Report – Internship Weekly Log Report 23-24.xlsx
2. Internship Evaluation Report – Evaluation Marksheet.pdf
3. Mid-Term Assessment Sheet – Evaluation CheckList.pdf
4. Internship Guidelines – Guidelines for Students and Mentors
5. Internship Policy – PCE Internship Policy 2023'24.pdf

Adm. Y 23-24