# Syllabus for B.Tech in Computer Science and Information Technology

## Contents :

## Key Notes

**The draft syllabus has been developed based on the existing CSE syllabus of MAKAUT and the AICTE Model Syllabus (2022), ensuring alignment with industry requirements and contemporary educational standards.**

1. Industry trends and demands have been carefully considered to make the syllabus relevant and future-ready.
2. Since the AICTE model syllabus is widely followed across institutions, some commonalities with other syllabi are inevitable.
3. The syllabus is structured to equip students with global competencies.
4. While the proposed syllabus is unique, similarities exist due to its foundation in the MAKAUT syllabus and AICTE model guidelines. Credit distribution across classified areas has been structured per MAKAUT norms, incorporating subject-wise and semester-wise modifications as recommended by the Board of Studies (BoS), which includes industry experts, faculty members, and external academicians.
5. The existing CSE syllabus for Semesters I & II is included without changes, as the first year remains common across all disciplines.
6. Paper codes for retained subjects and syllabi remain unchanged.
7. If an existing subject has been moved to a different semester, its paper code has been updated while keeping the syllabus intact.
8. Only newly introduced topics have undergone syllabus revision; existing subjects with unchanged content have been retained as is.
9. Course Outcomes (COs) for existing papers, where unavailable in online records, have been freshly created based on the syllabus content.
10. The proposed syllabus has been benchmarked against the AICTE model syllabus to ensure consistency and standardization.

**Maulana Abul Kalam Azad University of Technology**

**Syllabus for B. Tech. in Computer Science and Information Technology**

**Effective from Academic Session 25–26**

| First Year (First Semester) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Sl No. | Category | Subject Code | Subject Name | Total Number of contact hours | | | | Credits |
| | | | | L | T | P | H | |
| 1 | Basic Science Courses | BS–PH101/ BS–CH101 | Physics–I (Gr–A)/ Chemistry–I (Gr–B) | 3 | 1 | 0 | 4 | 4 |
| 2 | Basic Science Courses | BS–M101 | Mathematics–IA | 3 | 1 | 0 | 4 | 4 |
| 3 | Engineering Science Courses | ES–EE101 | Basic Electrical Engineering | 3 | 1 | 0 | 4 | 4 |
| | *Total Theory* | | | 9 | 3 | 0 | 12 | 12 |
| Practical | | | | | | | | |
| 4 | Basic Science Courses | BS–PH191/ BS–CH191 | Physics–I Laboratory (Gr–A)/Chemistry–I Laboratory (Gr–B) | 0 | 0 | 3 | 3 | 1.5 |
| 5 | Engineering Science Courses | ES–EE191 | Basic Electrical Engineering Laboratory | 0 | 0 | 2 | 2 | 1 |
| 6 | Engineering Science Courses | ES–ME191/ ES–ME192 | Engineering Graphics & Design (Gr–B) / Workshop/ Manufacturing Practices (Gr–A) | 1 | 0 | 4 | 5 | 3 |
| | *Total Practical* | | | 1 | 0 | 9 | 10 | 5.5 |
| | Total of First Semester | | | 10 | 3 | 9 | 22 | 17.5 |

| Sl No. | Category | Subject Code | Subject Name | Total Number of contact hours | | | | Credits |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | H | |
| 1 | Basic Science Courses | BS–PH201/ BS–CH201 | Physics–I (Gr–B)/ Chemistry–I (Gr–A) | 3 | 1 | 0 | 4 | 4 |
| 2 | Basic Science Courses | BS–M201 | Mathematics–IIA | 3 | 1 | 0 | 4 | 4 |
| 3 | Engineering Science Courses | ES–CS201 | Programming for Problem Solving | 3 | 0 | 0 | 3 | 3 |
| 4 | Humanities and Social Sciences including Management Courses | HM–HU201 | English | 2 | 0 | 0 | 2 | 2 |
| | *Total Theory* | | | 11 | 2 | 0 | 13 | 13 |
| Practical | | | | | | | | |
| 5 | Basic Science Courses | BS–PH291/ BS–CH291 | Physics–I Laboratory (Gr–B)/Chemistry–I Laboratory (Gr–A) | 0 | 0 | 3 | 3 | 1.5 |
| 6 | Engineering | ES–CS291 | Programming for Problem Solving | 0 | 0 | 4 | 4 | 2 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Science Courses | | | | | | | |
| 7 | Engineering Science Courses | ES–ME291/ ES–ME292 | Engineering Graphics & Design (Gr–A)/ Workshop / Manufacturing Practices (Gr–B) | 1 | 0 | 4 | 5 | 3 |
| 8 | Humanities and Social Sciences including Management Courses | HM–HU291 | Language Laboratory | 0 | 0 | 2 | 2 | 1 |
| | ***Total Practical*** | | | **1** | **0** | **13** | **14** | **7.5** |
| | **Total of Second Semester** | | | **12** | **2** | **13** | **27** | **20.5** |

| Sl No. | Category | Subject Code | Subject Name | Total Number of contact hours | | | | Credits |
|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | H | |
| 1 | Engineering Science Courses | ESC–301 | Analog and Digital Electronics | 3 | 0 | 0 | 3 | 3 |
| 2 | Professional Core Courses | PCC–CS301 | Data Structure & Algorithms | 3 | 0 | 0 | 3 | 3 |
| 3 | Professional Core Courses | PCC–CSIT301 | Discrete Mathematics | 3 | 0 | 0 | 3 | 3 |
| 4 | Professional Core Courses | PCC–CSIT302 | Formal Language & Automata Theory | 3 | 0 | 0 | 3 | 3 |
| 5 | Humanities and Social Sciences including Management Courses | HSMC–301 | Economics for Engineers (Humanities–II) | 3 | 0 | 0 | 3 | 3 |
| | ***Total Theory*** | | | **15** | **0** | **0** | **15** | **15** |
| **Practical** | | | | | | | | |
| 6 | Professional Core Courses | PCC–CS393 | IT Workshop (Sci Lab/MATLAB/Python/R) | 0 | 0 | 4 | 4 | 2 |
| 7 | Engineering Science Courses | ESC–391 | Analog and Digital Electronics | 0 | 0 | 4 | 4 | 2 |
| 8 | Professional Core Courses | PCC–CS391 | Data Structure & Algorithms | 0 | 0 | 4 | 4 | 2 |
| | ***Total Practical*** | | | **0** | **0** | **12** | **12** | **6** |
| | **Total of Third Semester** | | | **15** | **0** | **12** | **27** | **21** |

| Sl No. | Category | Subject Code | Subject Name | Total Number of contact hours | Credits |
|---|---|---|---|---|---|

| | | | | L | T | P | H | |
|---|---|---|---|---|---|---|---|---|
| 1 | Professional Core Courses | PCC–CSIT401 | Computer Organisation | 3 | 1 | 0 | 4 | 3 |
| 2 | Professional Core Courses | PCC–CSIT402 | Computer Network | 3 | 0 | 0 | 3 | 3 |
| 3 | Professional Core Courses | PCC–CSIT403 | Compiler Design | 3 | 0 | 0 | 3 | 3 |
| 4 | Professional Core Courses | PCC–CS404 | Design & Analysis of Algorithms | 3 | 0 | 0 | 3 | 3 |
| 5 | Basic Science Courses | BSC–401 | Biology | 2 | 1 | 0 | 3 | 3 |
| 6 | Mandatory Courses | MC–401 | Environmental Sciences | 1 | 0 | 0 | 1 | 0 |
| 7 | Humanities and Social Sciences including Management Courses | HSMC–401 | Introduction to Industrial Management (Humanities III) | 3 | 0 | 0 | 3 | 3 |
| | ***Total Theory*** | | | **18** | **2** | **0** | **20** | **18** |
| **Practical** | | | | | | | | |
| 8 | Professional Core Courses | PCC–CS494 | Design & Analysis of Algorithms | 0 | 0 | 4 | 4 | 2 |
| 9 | Professional Core Courses | PCC–CSIT491 | Computer Organisation | 0 | 0 | 4 | 4 | 2 |
| | ***Total Practical*** | | | **0** | **0** | **8** | **8** | **4** |
| | **Total of Fourth Semester** | | | **18** | **2** | **8** | **28** | **22** |

| Third Year (Fifth Semester) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Sl No. | Category | Subject Code | Subject Name | Total Number of contact hours | | | | Credits |
| | | | | L | T | P | H | |
| 1 | Engineering Science Courses | ESC–501 | Software Engineering | 3 | 0 | 0 | 3 | 3 |
| 2 | Professional Core Courses | PCC–CSIT501 | Computer Architecture | 3 | 0 | 0 | 3 | 3 |
| 3 | Professional Core Courses | PCC–CS502 | Operating Systems | 3 | 0 | 0 | 3 | 3 |
| 4 | Professional Core Courses | PCC–CSIT502 | Advanced Programming for Real Life Applications | 3 | 0 | 0 | 3 | 3 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 6 | Professional Elective Courses | | Elective I | 3 | 0 | 0 | 3 | 3 |
| | | PEC–IT501A | Theory of Computation | | | | | |
| | | PEC–CSIT501A | Signals & Systems | | | | | |
| | | PEC–CSIT501B | Mobile Computing | | | | | |
| | | PEC–IT501D | Computer Graphics | | | | | |
| 7 | Mandatory Courses | MC–CS501 | Constitution of India/ Essence of Indian Knowledge Tradition | 1 | | | | |
| | *Total Theory* | | | 16 | 0 | 0 | 15 | 15 |
| Practical | | | | | | | | |
| 7 | Professional Core Courses | PCC–CSIT591 | Computer Architecture | 0 | 0 | 4 | 4 | 2 |
| 8 | Engineering Science Courses | ESC–591 | Software Engineering | 0 | 0 | 4 | 4 | 2 |
| 9 | Professional Core Courses | PCC–CS592 | Operating Systems | 0 | 0 | 4 | 4 | 2 |
| 10 | Professional Core Courses | PCC–CSIT592 | Advanced Programming for Real Life Applications | 0 | 0 | 4 | 4 | 2 |
| | *Total Practical* | | | 0 | 0 | 16 | 16 | 8 |
| | Total of Fifth Semester | | | 16 | 0 | 16 | 31 | 23 |

| Fourth Year (Seventh Semester) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Sl No. | Category | Subject Code | Subject Name | Total Number of contact hours | | | | Credits |
| | | | | L | T | P | H | |
| 1 | Professional Core Courses | PCC–CSIT701 | Mobile Application Development | 3 | 1 | 0 | 4 | 3 |
| 2 | Professional Elective Courses | | Elective III | 3 | 0 | 0 | 3 | 3 |
| | | PEC–IT701B | Quantum Computing | | | | | |
| | | PEC–IT701C | Cloud Computing | | | | | |
| | | PEC– | Data Warehousing & Data Mining | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | CSIT701A | | | | | | |
| | | PEC–CSIT701B | Computer Vision | | | | | |
| 3 | Open Elective Courses | | Open Elective II | 3 | 0 | 0 | 3 | 3 |
| | | OEC–IT701A | Operations Research | | | | | |
| | | OEC–IT701B | Introduction to Philosophical Thoughts | | | | | |
| | | OEC–IT701C | Soft Skill & Interpersonal Communication | | | | | |
| | Humanities and Social Sciences including Management Courses | HSMC 701 | Project Management and Entrepreneurship | 2 | 1 | 0 | 3 | 3 |
| 4 | Project, Seminar, Internship | PROJ–IT781 | Project–II | 0 | 0 | 12 | 12 | 6 |
| | *Total Theory* | | | 11 | 2 | 12 | 25 | 18 |
| Practical | | | | | | | | |
| 5 | Professional Core Courses | PCC–CSIT791 | Mobile Application Development | 0 | 0 | 4 | 4 | 2 |
| | *Total Practical* | | | 0 | 0 | 4 | 4 | 2 |
| | Total of Seventh Semester | | | 11 | 2 | 16 | 29 | 20 |

| Fourth Year (Eight Semester) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Sl No. | Category | Subject Code | Subject Name | Total Number of contact hours | | | | Credits |
| | | | | L | T | P | H | |
| 1 | Professional Elective Courses | | Elective IV | 3 | 0 | 0 | 3 | 3 |
| | | PEC–IT801A | Cryptography & Network Security | | | | | |
| | | PEC–IT801B | Speech and Natural Language Processing | | | | | |
| | | PEC–IT801C | Internet of Things | | | | | |
| | | PEC–IT801D | Remote Sensing and GIS | | | | | |
| 2 | Open Elective Courses | | Open Elective III | 3 | 0 | 0 | 3 | 3 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | OEC–IT801B | Cyber Law and Ethics | | | | | |
| | | OEC–IT801D | Bioinformatics | | | | | |
| | | OEC–IT802C | Economic Policies in India | | | | | |
| 3 | Open Elective Courses | | Open Elective IV | 3 | 0 | 0 | 3 | 3 |
| | | OEC–IT801E | Robotics | | | | | |
| | | OEC–IT802A | E–Commerce and ERP | | | | | |
| | | OEC–IT802B | Micro–electronics and VLSI Design | | | | | |
| | | OEC–CSIT802A | Data Analytics | | | | | |
| 6 | Project, Seminar, Internship | PROJ–CS881 | Project–III | 0 | 0 | 12 | 12 | 6 |
| | *Total Theory* | | | 9 | 0 | 12 | 21 | 15 |
| | Total of Eight Semester | | | 9 | 0 | 12 | 21 | 15 |

| S No. | Code | Category | CSE Model Syllabus | | | | | | | | | CSE-IT Draft | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sem 1 | Sem 2 | Sem 3 | Sem 4 | Sem 5 | Sem 6 | Sem 7 | Sem 8 | Total | Sem 1 | Sem 2 | Sem 3 | Sem 4 | Sem 5 | Sem 6 | Sem 7 | Sem 8 | Total |
| 1 | Humanities and Social Sciences including Management Courses | Humanities and Social Sciences including Management courses | 1 | 6 | 3 | 3 | 3 | 0 | 0 | 0 | 16 | 0 | 3 | 3 | 3 | 0 | 0 | 3 | 0 | 12 |
| 2 | Basic Science Courses | Basic Science courses | 9 | 9 | 2 | 0 | 0 | 0 | 3 | 0 | 23 | 9.5 | 9.5 | 0 | 3 | 0 | 0 | 0 | 0 | 22 |
| 3 | Engineering Science Courses | Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc. | 8 | 8 | 10 | 0 | 3 | 0 | 0 | 0 | 29 | 8 | 8 | 5 | 0 | 5 | 0 | 0 | 0 | 26 |
| 4 | Professional Core Courses | Professional core courses | 0 | 0 | 8 | 18 | 14 | 14 | 5 | 0 | 59 | 0 | 0 | 13 | 16 | 15 | 15 | 5 | 0 | 64 |
| 5 | Professional Elective Courses | Professional Elective courses relevant to chosen specialization/branch | 0 | 0 | 0 | 0 | 0 | 6 | 3 | 3 | 12 | 0 | 0 | 0 | 0 | 3 | 3 | 3 | 3 | 12 |
| 6 | Open Elective Courses | Open subjects – Electives from other technical and /or emerging subjects | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 6 | 9 | 0 | 0 | 0 | 0 | 0 | 3 | 3 | 6 | 12 |
| 7 | Project, Seminar, Internship | Project work, seminar and internship in industry or elsewhere | 0 | 0 | 0 | 0 | 0 | 3 | 6 | 6 | 15 | 0 | 0 | 0 | 0 | 0 | 3 | 6 | 6 | 15 |
| 8 | Mandatory Courses | Mandatory Courses [Environmental Sciences, Induction Program, Indian Constitution, Essence of Indian Knowledge Tradition] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (non cr | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | **Total (*)** | **18** | **23** | **23** | **21** | **20** | **23** | **20** | **15** | **163** | **17.5** | **20.5** | **21** | **22** | **23** | **24** | **20** | **15** | **163** |

# Mapping of Course Outcomes with Program Outcomes

**PROGRAM OUTCOME (POs)**

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, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research–based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend andwrite effective reports and design documentation, make effective presentations, and giveand receive clear instructions.

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

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

## MODEL PROGRAM SPECIFIC OUTCOMES (PSOs)

1. The Computer Science and Engineering graduates are able to analyze, design, develop, test and apply skills on the basis of mathematical and programming foundations in the development of computational solutions to design software and hardware.
2. Work with and communicate effectively with professionals in inter–disciplinary fields and pursue lifelong professional development in computing and identify research gaps and hence to provide solution to new ideas and innovations to satisfy the environmental and social issues.

**CO Statements and CO-PO Mapping for Courses of New Syllabus:**

**SEMESTER – I**

**THEORY**

| | |
|---|---|
| **Course Title: Mathematics –IA** | **Code: BS-M101** |
| **Type of Course: Theory** | **Course Designation: Compulsory** |
| **Semester: 1st** | **Contact Hours: 3L+1T/week** |
| **Continuous Assessment: 25 Marks** | **Final Exam: 70 Marks** |
| **Writer: Course Coordinator** | **Approved by HoD (convenor of DAB)** |

**COURSE OUTCOMES (COs)**

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

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| **BS-M101.CO1** | Learn the basic mathematical tools to deal with problems of engineering sciences. | Learn | Level I |
| **BS-M101.CO2** | Understand properties and application of Calculus and Linear Algebra . | Understand | Level II |
| **BS-M101.CO3** | Analyze of physical or engineering problems. | Analyze | Level IV |
| **BS-M101.CO4** | Acquire problem solving skills related to engineering science. | Acquire | Level II |
| **BS-M101.CO5** | Apply Calculus and Linear Algebra in real life problems. | Apply | Level III |
| **BS-M101.CO6** | Classify ensembles and differentiate between Calculus and Linear Algebra. | Classify | Level IV |

**Mapping of COs with POs and PSOs (Course Articulation Matrix):**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 3 | 3 | 2 |
| **CO2** | 3 | 3 | 3 | 3 | - | - | - | - | - | - | - | 3 | 2 | 1 |
| **CO3** | 3 | 3 | 3 | 2 | - | - | - | - | - | - | - | 3 | 2 | 1 |
| **CO4** | 3 | 1 | 2 | 1 | - | - | - | - | - | - | 1 | 3 | 2 | 2 |
| **CO5** | 2 | 2 | 2 | 2 | - | - | - | - | - | - | 2 | 3 | 1 | - |
| **CO6** | 3 | 2 | 2 | 2 | - | - | - | - | - | - | 2 | 3 | - | - |
| **AVG.** | 2.83 | 2.33 | 2.5 | 2.33 | 0 | 0 | 0 | 0 | 0 | 0 | 1.6667 | 3 | 2 | 1.5 |

**University Syllabus :**

| Unit | Content | Hrs/Unit |
|---|---|---|
| 1 | Calculus (Integration): Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions. | 8 |
| 2 | Calculus (Dif erentiation): Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin's theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima. | 6 |
| 3 | Matrices: Matrices, Vectors: addition and scalar multiplication, matrix multiplication; Linear systems of equations, linear Independence, rank of a matrix, determinants, Cramer's Rule, inverse of a matrix, Gauss elimination and Gauss-Jordan elimination. | 7 |
| 4 | Vector Spaces: Vector Space, linear dependence of vectors, Basis, Dimension; Linear transformations (maps), Range and Kernel of a linear map, Rank and Nullity, Inverse of a linear transformation, Rank-Nullity theorem, composition of linear maps, Matrix associated with a linear map. | 9 |
| 5 | Vector Spaces (Continued): Eigenvalues, Eigenvectors, Symmetric, Skew-symmetric, and Orthogonal Matrices, Eigenbases. Diagonalization; Inner product spaces, Gram-Schmidt orthogonalization. | 10 |

| | |
|---|---|
| **Course Title: Physics-I** | **Code: BS-PH101** |
| **Type of Course: Theory** | **Course Designation: Compulsory** |
| **Semester: 1st** | **Contact Hours: 3L+1T/week** |
| **Continuous Assessment: 25 Marks** | **Final Exam: 70 Marks** |
| **Writer: Course Coordinator** | **Approved by HoD (convenor of DAB)** |

**COURSE OUTCOMES (COs)**

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| **BS-PH101.CO1** | Apply basic concepts of mechanics | Apply | K3 |
| **BS-PH101.CO2** | Discuss Physical optics and analyze principles of lasers with applications | Discuss | K6 |
| **BS-PH101.CO3** | Categorize di electric and magnetic properties of materials leading to Electromagnetic laws | Categorize | K4 |
| **BS-PH101.CO4** | Differentiate between Classical Physics and Quantum Physics by introducing Planck's law | Differentiate | K5 |
| **BS-PH101.CO5** | Apply wave particle duality in real life problems followed by simple quantum mechanics calculations | Apply | K3 |
| **BS-PH101.CO6** | Classify ensembles and differentiate between classical and Quantum statistical mechanics | Classify | K4 |

**Mapping of COs with Pos and PSOs (Course Articulation Matrix):**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - |
| **CO2** | 1 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - |
| **CO3** | 3 | 2 | 1 | 1 | - | - | - | - | - | - | - | - | - | - |
| **CO4** | 1 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - |
| **CO5** | 1 | 3 | 2 | 0 | - | - | - | - | - | - | - | - | - | - |
| **CO6** | - | 1 | 3 | 2 | - | - | - | - | - | - | - | - | - | - |
| **AVG.** | 1.80 | 2.33 | 1.83 | 1.00 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

**University Syllabus :**

| Unit | Content | Hrs/Unit |
|---|---|---|
| 1 | Mechanics ( 7L) Problems including constraints & friction. Basic ideas of vector calculus and partial differential equations. Potential energy function F = -grad V, equipotential surfaces and meaning of gradient. Conservative and non-conservative forces. Conservation laws of energy & momentum. Non-inertial frames of reference. Harmonic oscillator; Damped harmonic motion forced oscillations and resonance. Motion of a rigid body in a plane and in 3D. Angular velocity vector. Moment of inertia. | 7 |
| 2 | Optics (5L)<br>Distinction between interference and diffraction, Fraunhofer and Fresnel diffraction, Fraunhofer diffraction at single slit, double slit, and multiple slits ( only the expressions for max;min, & intensity and qualitative discussion of fringes); diffraction grating(resolution formulac only), characteristics of diffration grating and its applications.<br>Polarisation : Introduction, polarisation by reflection, polarisation by double reflection, scattering of light, circular and elliptical polarisation, optical activity.<br>Lasers : Principles and working of laser : population inversion, pumping, various modes, threshold population inversion with examples . | 5 |
| 3 | Electromagnetism and Dielectric Magnetic Properties of Materials (8L)<br>Maxwell's equations. Polarisation, permeability and dielectric constant, polar and non-polar dielecrrics, internal fields in a solid, Clausius- Mossotti equation(expression only), applications of dielectrics.<br>Magnetisation , permeability and susceptibility, classificationof magnetic materials, ferromagnetism, magnetic domains and hysteresis, applications. | 8 |

| | | |
|---|---|---|
| 4 | Quantum Mechanics (16L)<br>Introduction to quantum physics, black body radiation, explanation using the photon concept, Compton effect, de Broglie hypothesis, wave-particle duality, verification of matter waves, uncertainty principle, Schrodinger wave equation, particle in box, quantum harmonic oscillator, hydrogen atom. | 16 |
| 5 | Statistical Mechanics (8L) Macrostate, Microstate, Density of states, Qualitative treatment of Maxwell Boltzmann, Fermi-Dirac and Bose-Einstein statistics. | 8 |

| | |
|---|---|
| **Course Title: Basic Electrical Engineering** | **Code: ES-EE101** |
| **Type Of Course: Theory** | **Course Designation: Compulsory** |
| **Semester: 1st** | **Contact Hours: 3L+1T/week** |
| **Continuous Assessment: 25 Marks** | **Final Exam: 70 Marks** |
| **Writer: Course Coordinator** | **Approved by HoD (convenor of DAB)** |

**COURSE OUTCOMES (COs)**

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

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| **ES-EE101.CO1** | Understand and analyze basic electric and magnetic circuits. | Understand | K2 |
| **ES-EE101.CO2** | Study the working principles of electrical machines and power converters. | Study | K1 |
| **ES-EE101.CO3** | Introduce the components of low voltage electrical installations. | Introduce | K1 |
| **ES-EE101.CO4** | Understand the general structure of electrical power system. | Understand | K2 |
| **ES-EE101.CO5** | Understand the construction and operation of single-phase transformer. | Understand | K2 |
| **ES-EE101.CO6** | Explain the working principle of power converters. | Explain | K2 |

**Mapping of COs with Pos and PSOs (Course Articulation Matrix):**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | - | - | 2 | - | - | - | - | - | - | - | - | - |
| **CO2** | 2 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | - | - | - |
| **CO3** | 2 | - | 3 | 1 | - | - | - | - | - | - | - | 1 | - | - |
| **CO4** | 2 | - | 2 | 2 | 3 | - | - | - | - | - | - | 2 | - | - |
| **CO5** | 2 | 2 | - | 2 | 3 | - | - | - | - | - | - | 1 | - | - |
| **CO6** | 2 | 1 | 3 | 3 | 3 | - | - | - | - | - | - | 1 | - | - |
| **AVG.** | 2.17 | 2 | 2.75 | 2 | 2.6 | 0 | 0 | 0 | 0 | 0 | 0 | 1.25 | 0 | 0 |

**University Syllabus :**

| Unit | Content | Hrs/Unit |
|---|---|---|
| 1 | DC Circuits (8 hours) Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits. | 8 |
| 2 | AC Circuits (8 hours) Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections. | 8 |

| | | |
|---|---|---|
| 3 | Transformers (6 hours) Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections. | 6 |
| 4 | Electrical Machines (8 hours) Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators. | 8 |
| 5 | Power Converters (6 hours) DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation | 6 |
| 6 | Electrical Installations (6 hours) Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup. | 6 |

**SEMESTER – I**
**PRACTICAL**

| | |
|---|---|
| **Course Title: Physics-I Laboratory** | **Code: BS-PH191** |
| **Type of Course: Practical** | **Course Designation: Compulsory** |
| **Semester: 1st** | **Contact Hours: 3P/week** |
| **Continuous Assessment: 40 Marks** | **Final Exam: 60 Marks** |
| **Writer: Course Coordinator** | **Approved by HoD (convenor of DAB)** |

**COURSE OUTCOMES (COs)**

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

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| **BS-PH191.CO1** | Observe and read data in slide calliper's, screw gauge. Calculate different modulus of elasticity to apply basic knowledge Physics of Elasticity and apply viscosity principle of streamline motion of water to calculate its viscosity coefficient required in fluid mechanics | Observe | K1 |
| **BS-PH191.CO2** | Arrange sequential connection in electrical experiment to verify principles of Kirchhoff's law to verify passive elements of electrical circuit | Arrange | K3 |
| **BS-PH191.CO3** | Operate optical instruments to illustrate physical properties of light and to observe spectral lines of light to verify medium specific characteristics. Calculate Rydberg constant by studying Hydrogen spectrum to visualize visible spectra and to assess this empirical fitting parameter as a fundamental physical constant | Operate | K3 |
| **BS-PH191.CO4** | Determine Band Gap and Hall coefficient of a given intrinsic semiconductor and distinguish between different intrinsic semiconductors. Determine the dielectric constant of different capacitors to correlate their usage like insulator and limitation of their usage as a dielectric material. | Determine | K5 |
| **BS-PH191.CO5** | Apply concepts of quantum mechanics to verify Bohr's atomic orbital theory | Apply | K3 |
| **BS-PH191.CO6** | Determine Planck's constant and Stefan's constant applying modern Physics | Determine | K5 |

**Mapping of COs with Pos and PSOs (Course Articulation Matrix):**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 3 | 1 | 1 | - | - | - | - | - | - | - | - | - | - |
| **CO2** | 2 | 3 | 1 | 1 | - | - | - | - | - | - | - | - | - | - |
| **CO3** | 2 | 2 | 3 | 1 | - | - | - | - | - | - | - | - | - | - |
| **CO4** | 2 | 3 | 1 | 2 | - | - | - | - | - | - | - | - | - | - |
| **CO5** | 2 | 2 | 3 | 1 | - | - | - | - | - | - | - | - | - | - |
| **CO6** | 2 | 1 | 3 | 2 | - | - | - | - | - | - | - | - | - | - |
| **AVG.** | 2 | 2.33 | 2 | 1.33 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

**University Syllabus :**

**Choose 10 experiments including at least one from Optics, Electricity and Magnetism and Quantum Mechanics and at least a total of six from these three groups.**

| Unit | Content |
|---|---|
| 1 | Experiments in Optics<br>1. Determination of dispersive power of the material of a prism<br>2. Determination of wavelength of a monochromatic light by Newton's ring<br>3. Determination of wavelength of a monochromatic light by Fresnel's bi-prism<br>4. Determination of wavelength of the given laser source by diffraction method |
| 2 | Electricity & Magnetism experiments<br>1. Determination of thermo electric power of a given thermocouple.<br>2. Determination of specific charge (e/m) of electron by J.J. Thompson's method.<br>3. Determination of dielectric constant of a given dielectric material.<br>4. Determination of Hall coefficient of a semiconductor by four probe method.<br>5. To study current voltage characteristics, load response, areal characteristic and spectral response of a photovoltaic solar cell.<br>6. Determination of resistance of ballistic galvanometer by half deflection method and study of variation of logarithmic decrement with series resistance.<br>7. Determination of unknown resistance using Carey Foster's bridge<br>8. Study of Transient Response in LR, RC and LCR circuits using expeyes<br>9. Generating sound from electrical energy using expeyes |
| 3 | Experiments in Quantum Physics<br>1. Determination of Stefan-Boltzmann constant.<br>2. Determination of Planck constant using photocell.<br>3. Determination of Lande-g factor using Electron spin resonance spectrometer.<br>4. Determination of Rydberg constant by studying Hydrogen spectrum.<br>5. Determination of Band gap of semiconductor.<br>6. To study current voltage characteristics, load response, areal characteristic and spectral response of a photovoltaic solar cell. |
| 4 | Miscellaneous experiments<br>1. Determination of Young's modulus of elasticity of the material of a bar by the method of flexure<br>2. Determination of bending moment and shear force of a rectangular beam of uniform cross-section<br>3. Determination of modulus of rigidity of the material of a rod by static method<br>4. Determination of rigidity modulus of the material of a wire by dynamic method<br>5. To determine the moment of inertia of a body about an axis passing through its centre of gravity and to determine the modulus of rigidity of the material of the suspended wire<br>6. Determination of coefficient of viscosity by Poiseulle's capillary flow method |

| | |
|---|---|
| **Course Title: Basic Electrical Engineering Lab** | **Code: ES-EE191** |
| **Type of Course: Practical** | **Course Designation: Compulsory** |
| **Semester: 1st** | **Contact Hours: 2P/week** |
| **Continuous Assessment: 40 Marks** | **Final Exam: 60 Marks** |
| **Writer: Course Coordinator** | **Approved by HoD (convenor of DAB)** |

**COURSE OUTCOMES (COs)**

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

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| **ES-EE191.CO1** | Calibrate Ammeter and Wattmeter | Calibrate | **K3** |
| **ES-EE191.CO2** | Demonstrate the measuring instrument and electrical machines | Demonstrate | K3 |
| **ES-EE191.CO3** | Conduct open circuit and short circuit test of single-phase transformer | Conduct | K2 |
| **ES-EE191.CO4** | Measure 3 phase power using two wattmeters | Measure | **K5** |
| **ES-EE191.CO5** | Identify the components of LT switchgear | Identify | K1 |
| **ES-EE191.CO6** | Understand the characteristic of RLC series and parallel circuit | Understand | K2 |

**Mapping of COs with Pos and PSOs (Course Articulation Matrix):**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | - | - | - | 3 | - | - | - | 2 | - | - | - | - | - |
| **CO2** | 2 | 3 | 3 | 1 | 2 | - | - | - | 3 | - | - | - | - | - |
| **CO3** | 2 | 2 | 3 | - | - | - | - | - | 2 | - | - | - | - | - |
| **CO4** | 2 | - | 2 | - | 3 | - | - | - | 3 | - | - | - | - | - |
| **CO5** | 1 | - | - | - | 1 | - | - | - | - | - | - | - | - | - |
| **CO6** | 2 | 1 | 2 | 1 | 3 | - | - | - | 2 | - | - | - | - | - |
| **AVG.** | 1.83 | 2 | 2.5 | 1 | 2.4 | 0 | 0 | 0 | 2.4 | 0 | 0 | 0 | 0 | 0 |

**University Syllabus :**

**Choose 10 experiments from the following:**

| Unit | Content |
|---|---|
| 1 | First activity: Introduction to basic safety precautions and mentioning of the do's and Don'ts. Noting down list of experiments to be performed, and instruction for writing the laboratory reports by the students. Group formation. Students are to be informed about the modalities of evaluation. |
| 2 | Introduction and uses of following instruments : (a) Voltmeter (b) Ammeter (c) Multimeter (d) Oscilloscope<br>Demonstration of real life resistors, capacitors with color code , inductors and autotransformer. |
| 3 | Demonstration of cut-out sections of machines: DC machine, Induction machine, Synchronous machine and single phase induction machine. |
| 4 | Calibration of ammeter and Wattmeter. |
| 5 | Determination of steady state and transient response of R-L, R-C and R-L-C circuit to a step change in voltage. |
| 6 | Determination of steady state response of R-L and R-C and R-L-C circuit and calculation of impedance and power factor. |
| 7 | Determination of resonance frequency and quality factor of series and parallel R-L-C circuit. |
| 8 | (a) Open circuit and short circuit test of a single-phase transformer<br>(b) Load test of the transformer and determination of efficiency and regulation |
| 9 | Demonstration of three phase transformer connections. Voltage and current relationship, phase shifts between the primary and secondary side. |
| 10 | Measurement of power in a three phase unbalanced circuit by two wattmeter method. |
| 11 | Determination of Torque –Speed characteristics of separately excited DC motor. |
| 12 | Determination of Torque speed characteristics and observation of direction reversal by change of phase sequence of connection of Induction motor. |
| 13 | Determination of operating characteristics of Synchronous generator. |
| 14 | Demonstration of operation of (a) DC-DC converter (b) DC-AC converter (c) DC-AC converter for speed control of an Induction motor. |
| 15 | Demonstration of components of LT switchgear. |

| | |
|---|---|
| **Course Title: Workshop** | **Code: ES-ME192** |
| **Type Of Course: Practical** | **Course Designation: Compulsory** |
| **Semester: 1st** | **Contact Hours: 1L+4P/week** |
| **Continuous Assessment: 40 Marks** | **Final Exam: 60 Marks** |
| **Writer: Course Coordinator** | **Approved by HoD (convenor of DAB)** |

**COURSE OUTCOMES (COs)**

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

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| **ES-ME192.CO1** | Understanding the applications of hand tools and machine tools. | Understand | K2 |
| **ES-ME192.CO2** | Comprehend the safety measures required to be taken while using the tools. | Comprehend | K2 |
| **ES-ME192.CO3** | Select the appropriate tools required to manufacture an object of predetermined shape and size considering least wastage and cost. | Select | K2 |
| **ES-ME192.CO4** | Fabricate components with their own hands | Fabricate | K6 |
| **ES-ME192.CO5** | Practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes | Analyze | K6 |
| **ES-ME192.CO6** | Produce small devices of their interest, by assembling different components, | Produce | K6 |

**Mapping of COs with Pos and PSOs (Course Articulation Matrix):**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **CO2** | 1 | - | - | - | - | 1 | - | 1 | - | - | - | - | - | - |
| **CO3** | 1 | - | - | - | - | 1 | - | 1 | 1 | - | - | - | - | - |
| **CO4** | 1 | - | - | - | - | - | 2 | - | 2 | 1 | 1 | - | - | 1 |
| **CO5** | 1 | - | - | - | - | - | 2 | - | 2 | 1 | 1 | 1 | - | - |
| **CO6** | 1 | - | - | - | - | - | 2 | - | 2 | 1 | 2 | 1 | - | 1 |
| **AVG.** | 1 | 0 | 0 | 0 | 0 | 1 | 2 | 1 | 1.75 | 1 | 1.33 | 1 | 0 | 1 |

**University Syllabus :**

| Unit | Content |
|---|---|
| 1 | **Lectures & videos: Detailed contents:**<br>1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods<br>2. CNC machining, Additive manufacturing<br>3. Fitting operations & power tools<br>4. Electrical &Electronics<br>5. Carpentry<br>6. Plastic moulding, glass cutting |

| | |
|---|---|
| | 7. Metal casting 8. Welding (arc welding & gas welding), brazing |
| 2 | **Workshop Practice:**<br>**Machine shop (8 hours)**<br>Typical jobs that may be made in this practice module:<br>To make a pin from a mild steel rod in a lathe.<br>To make rectangular and vee slot in a block of cast iron or mild steel in a shaping and / or milling machine.<br>Fitting shop (8 hours)<br>Typical jobs that may be made in this practice module:<br>To make a Gauge from MS plate.<br>**Carpentry (8 hours)**<br>Typical jobs that may be made in this practice module:<br>To make wooden joints and/or a pattern or like.<br>**Welding shop (8 hours (Arc welding 4 hrs + gas welding 4 hrs))**<br>Typical jobs that may be made in this practice module: ARC WELDING (4 hours):<br>To join two thick (approx 6mm) MS plates by manual metal arc welding.<br>GAS WELDING (4 hours): To join two thin mild steel plates or sheets by gas welding. **Casting (8 hours)**<br>Typical jobs that may be made in this practice module: One/ two green sand moulds to prepare, and a casting be demonstrated.<br>Smithy (4 hours)<br>Typical jobs that may be made in this practice module: A simple job of making a square rod from a round bar orlike.<br>**Plastic moulding & Glass cutting (4 hours)** Typical jobs that may be made in this practice module:<br>For plastic moulding, making at least one simple plastic component should be made.<br>For glass cutting, three rectangular glass pieces may be cut to make a kaleidoscope using a black colour diamond cutter, or similar other components may be made. Electrical &**Electronics (8 hours)**<br>**Familiarization with LT switchgear elements, making its sketches and noting down its specification.**<br>Kitkat fuse, Glass cartridge fuse, Plastic fuse holders (optional), Iron clad isolators, MCB style isolators, Single phase MCB, Single-phase wire, wiring cable.<br>Demonstration of domestic wiring involving two MCB, two piano key switches, one incandescent lamp, one LED lamp and plug point. Simple wiring exercise to be executed to understand the basic electrical circuit.<br>Simple soldering exercises to be executed to understand the basic process ofsoldering. Fabrication of a single-phase full wave rectifier with a step down transformer using four diodes and electrolytic capacitor and to find its volt-ampere characteristics to understand basic electronic circuit fabrication. |

**SEMESTER – II**
**THEORY**

| | |
|---|---|
| **Course Title: Chemistry-I** | **Code: BS-CH 201** |
| **Type of Course: Theory** | **Course Designation: Compulsory** |
| **Semester: 2nd** | **Contact Hours: 3L+1T/week** |
| **Continuous Assessment: 25 Marks** | **Final Exam: 70 Marks** |
| **Writer: Course Coordinator** | **Approved by HoD (convenor of DAB)** |

**COURSE OUTCOMES (COs)**

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

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| **BS-CH 201.CO1** | Apply first and second law of thermodynamics to different chemical and physical processes under specified condition to determine the equilibrium condition, spontaneity and thermo-chemical behaviour of a reaction. | Apply | K3 |
| **BS-CH 201.CO2** | Using the concept of conductance of ions analyze the design and working principle of different electrochemical cells. | Use | K3 |
| **BS-CH 201.CO3** | Derive rate of a reaction at a specified temperature under different medium | Derive | K4 |
| **BS-CH 201.CO4** | Explain the mechanism considering the structure of the molecules and type of electronic effect present in them. | Explain | K5 |
| **BS-CH 201.CO5** | Analyze different types of fuels for industrial application. | Analyze | K4 |
| **BS-CH 201.CO6** | Distinguish different types of polymer for diverse application. | Distinguish | K4 |

**Mapping of COs with POs and PSOs (Course Articulation Matrix):**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 1 | 1 | - | - | - | - | - | - | - | - | - | - |
| **CO2** | 3 | 2 | 1 | - | - | - | - | - | - | - | - | - | - | - |
| **CO3** | 3 | 2 | 1 | 1 | - | - | - | - | - | - | - | - | - | - |
| **CO4** | 3 | 2 | 1 | 1 | - | - | - | - | - | - | - | - | - | - |
| **CO5** | 3 | 1 | 1 | - | - | - | - | - | - | - | - | - | - | - |
| **CO6** | 3 | 1 | 1 | 1 | - | - | - | - | - | - | - | - | - | - |
| **AVG.** | 3 | 1.66 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

**University Syllabus :**

| Unit | Content | Hrs/Unit |
|---|---|---|
| 1 | **Atomic and molecular structure (10 lectures)**<br>Schrodinger equation. Particle in a box solutions and their applications for simple sample. Molecular orbitals of diatomic molecules (e.g.H2). Energy level diagrams of diatomic. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures. | 10 |

| | | |
|---|---|---|
| 2 | **Spectroscopic techniques and applications (8 lectures)**<br>Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterisation techniques. Diffraction and scattering. | 8 |

| | | |
|---|---|---|
| 3 | **Intermolecular forces and potential energy surfaces (4 lectures)**<br>Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena | 4 |
| 4 | **Use of free energy in chemical equilibria (8 lectures)**<br>First and second laws of thermodynamics and thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion. Use of free energy considerations in metallurgy through Ellingham diagrams | 8 |
| 5 | **Periodic properties (4 Lectures)**<br>Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries | 4 |
| 6 | **Stereochemistry (4 lectures)**<br>Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compound | 4 |
| 7 | **Organic reactions and synthesis of a drug molecule (4 lectures)**<br>Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule. | 4 |

| | |
|---|---|
| **Course Title:Mathematics –IIA** | **Code: BS-M201** |
| **Type of Course: Theory** | **Course Designation: Compulsory** |
| **Semester: 2nd** | **Contact Hours: 3L+1T/week** |
| **Continuous Assessment: 25 Marks** | **Final Exam: 70 Marks** |
| **Writer: Course Coordinator** | **Approved by HoD (convenor of DAB)** |

**COURSE OUTCOMES (COs)**

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

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| **BS-M201.CO1** | Learn the basic mathematical tools to deal with problems of engineering sciences. | Learn | K1 |
| **BS-M201.CO2** | Understand properties and application of Linear Algebra, Ordinary Differential Equations (ODE) and numerical analysis. | Understand | K2 |
| **BS-M201.CO3** | Analyze of physical or engineering problems. | Analyze | K4 |
| **BS-M201.CO4** | Acquire problem solving skills related to engineering science. | Acquire | K2 |
| **BS-M201.CO5** | Apply Linear Algebra, Ordinary Differential Equations (ODE) and Numerical analysis in real life problems. | Apply | K3 |
| **BS-M201.CO6** | Classify ensembles and differentiate among Linear Algebra, Ordinary Differential Equations (ODE) and numerical analysis. | Classify | K4 |

**Mapping of COs with POs and PSOs (Course Articulation Matrix):**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 3 | 1 | - | - | - | - | - | - | - | 3 | 1 | - |
| **CO2** | 2 | 2 | 3 | 1 | - | - | - | - | - | - | - | 3 | 2 | - |
| **CO3** | 3 | 3 | 3 | 1 | - | - | - | - | - | - | - | 3 | 1 | - |
| **CO4** | 3 | 2 | 3 | 2 | - | - | - | - | - | - | 1 | 3 | 3 | 1 |
| **CO5** | 3 | 2 | 3 | 2 | - | - | - | - | - | - | 2 | 3 | 3 | -1 |
| **CO6** | 3 | 2 | 3 | 2 | - | - | - | - | - | - | 2 | 3 | 3 | 2 |
| **AVG.** | 2.83 | 2.17 | 3 | 1.5 | 0 | 0 | 0 | 0 | 0 | 0 | 1.67 | 3.00 | 2.17 | 1.33 |

**University Syllabus :**

| Unit | Content | Hrs/Unit |
|---|---|---|
| 1 | **Basic Probability:** Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the Multinomial distribution, Poisson approximation to the Binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality. | 11 |
| 2 | **Continuous Probability Distributions:** Continuous random variables and their properties, Distribution functions and densities, Normal, Exponential and Gamma densities. | 4 |
| 3 | **Bivariate Distributions:** Bivariate distributions and their properties, distribution of sums and quotients, Conditional densities, Bayes' rule. | 5 |
| 4 | **Basic Statistics:** Measures of Central tendency, Moments, Skewness and Kurtosis, Probability distributions: Binomial, Poisson and Normal and evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation | 8 |
| 5 | **Applied Statistics:** Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for | 8 |
| | single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations. | |
| 6 | **Small samples:** Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes. | 4 |

| | |
|---|---|
| **Course Title:Programming for ProblemSolving** | **Code: ES-CS201** |
| **Type of Course: Theory** | **Course Designation: Compulsory** |
| **Semester: 2nd** | **Contact Hours: 3L+1T/week** |
| **Continuous Assessment: 25 Marks** | **Final Exam: 70 Marks** |
| **Writer: Course Coordinator** | **Approved by HoD (convenor of DAB)** |

**COURSE OUTCOMES (COs)**

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

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| **ES-CS201.CO1** | Analyze the problem and formulate algorithms for them. | Analyze | K4 |
| **ES-CS201.CO2** | Translate the algorithms to programs (in C language). | Understand | K2 |
| **ES-CS201.CO3** | Understand the correct syntax of logical expression, branch instruction, iteration, | Understand | K2 |
| **ES-CS201.CO4** | Apply array and pointer to solve problem. | Apply | K3 |
| **ES-CS201.CO5** | Understand the use of , function, recursion. | Understand | K2 |
| **ES-CS201.CO6** | Build analytical skill. | Create | K6 |

**Mapping of COs with POs and PSOs (Course Articulation Matrix):**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 3 |
| **CO2** | 3 | 3 | 3 | 3 | - | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 3 |
| **CO3** | 3 | 3 | 3 | 3 | - | - | - | - | 1 | 1 | - | 2 | 2 | 2 |
| **CO4** | 3 | 3 | 3 | 3 | - | - | - | - | 1 | 1 | - | 2 | 2 | 2 |
| **CO5** | 3 | 3 | 3 | 3 | - | - | - | - | 1 | 1 | - | 2 | 2 | 2 |
| **CO6** | 3 | 3 | 3 | 3 | - | - | - | - | 1 | 1 | - | 2 | 2 | 2 |
| **AVG.** | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2.33 | 2.33 |

**University Syllabus :**

| Unit | Content | Hrs/Unit |
|---|---|---|
| 1 | **Introduction to Programming** (4 lectures) Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) - (1 lecture). Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples. (1 lecture) From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code- (2 lectures) | 8 |
| 2 | **Arithmetic expressions and precedence** (2 lectures) | 2 |
| 3 | **Conditional Branching and Loops** (6 lectures) Writing and evaluation of conditionals and consequent branching (3 lectures) Iteration and loops (3 lectures) | 6 |
| 4 | **Arrays** (6 lectures) Arrays (1-D, 2-D), Character arrays and Strings | 6 |
| 5 | **Basic Algorithms** (6 lectures) Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required) | 6 |
| 6 | **Function** (5 lectures) Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference | 5 |

| | | |
|---|---|---|
| 7 | **Recursion** (4 -5 lectures) Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort. | 5 |
| 8 | **Structure** (4 lectures) Structures, Defining structures and Array of Structures | 4 |
| 9 | **Pointers** (2 lectures) Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation) | 2 |
| 10 | **File handling** (only if time is available, otherwise should be done as part of the lab) | |

| | |
|---|---|
| **Course Title:English** | **Code: HM-HU201** |
| **Type of Course: Theory** | **Course Designation: Compulsory** |
| **Semester: 2nd** | **Contact Hours: 2L/week** |
| **Continuous Assessment: 25 Marks** | **Final Exam: 70 Marks** |
| **Writer: Course Coordinator** | **Approved by HoD (convenor of DAB)** |

**COURSE OUTCOMES (COs)**

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

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| **HM-HU201.CO1** | Understand and apply English Speech Sounds for enhancing English Communication | Understand | K2 |
| **HM-HU201.CO2** | Apply English Language Presentation Skill in Academic and in Professional Communication | Apply | K3 |
| **HM-HU201.CO3** | Apply Receptive Skills of English in Academics and in Engineering Profession | Apply | K3 |
| **HM-HU201.CO4** | Apply Writing Skill of English in Academics and in Profession | Apply | K3 |
| **HM-HU201.CO5** | Apply Grammar Skill of English in Academic and in Professional Communication | Apply | K3 |
| **HM-HU201.CO6** | Apply Critical Thinking Skill of English in Academic and in professionional Communication | Apply | K3 |

**Mapping of COs with POs and PSOs (Course Articulation Matrix):**

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

**University Syllabus :**

| Unit | Content |
|---|---|

| | |
|---|---|
| 1 | **Vocabulary Building**<br>1.1 The concept of Word Formation: Compounding, Backformation, Clipping, Blending.<br>1.2 Root words from foreign languages and their use in English<br>1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.<br>1.4 Synonyms, antonyms, and standard abbreviations: Acronyms |
| 2 | **Basic Writing Skills**<br>2.1 Sentence Structures & Types: Simple, Compound, Complex<br>2.2 Use of phrases and clauses in sentences: Transformation of sentences, active, passive, narration<br>2.3 Importance of proper punctuation |

| | |
|---|---|
| | 2.4 Creating coherence: Arranging paragraphs & Sentences in logical order<br>2.5 Creating Cohesion: Organizing principles of paragraphs in documents<br>2.6 Techniques for writing precisely |
| 3 | **Identifying Common Errors in Writing**<br>3.1 Subject-verb agreement<br>3.2 Noun-pronoun agreement<br>3.3 Misplaced modifiers<br>3.4 Articles<br>3.5 Prepositions<br>3.6 Redundancies<br>3.7 Clichés |
| 4 | **Nature and Style of sensible Writing**<br>4.1 Describing<br>4.2 Defining<br>4.3 Classifying<br>4.4 Providing examples or evidence<br>4.5 Writing introduction and conclusion |
| 5 | **Writing Practices**<br>5.1 Comprehension<br>5.2 Précis Writing<br>5.3 Essay Writing<br>5.4 Business Letter, Cover Letter & CV; E-mail |

**SEMESTER – II**
**PRACTICAL**

| | |
|---|---|
| **Course Title:Chemistry-I Laboratory** | **Code: BS-CH291** |
| **Type of Course: Practical** | **Course Designation: Compulsory** |
| **Semester: 2nd** | **Contact Hours: 3P/week** |
| **Continuous Assessment: 40 Marks** | **Final Exam: 60 Marks** |
| **Writer: Course Coordinator** | **Approved by HoD (convenor of DAB)** |

**COURSE OUTCOMES (COs)**

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

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| **BS-CH291.CO1** | Determine some physical parameter like viscosity of a solution and rate constant of a reaction | Determine | K5 |
| **BS-CH291.CO2** | Determine the strength of an acid using conductometric method. | Determine | K5 |
| **BS-CH291.CO3** | Determine the strength of an acid using pH metric method. | Determine | K5 |
| **BS-CH291.CO4** | Determine partition coefficient of a compound | Determine | K5 |
| **BS-CH291.CO5** | Estimate the amount of an ion present in a given solution using permanganometric and argentometric methods. | Estimate | K5 |
| **BS-CH291.CO6** | Evaluate alkalinity (in terms of CaCO3 equvalent), hardness (in ppm) and amount of dissolved oxyzen (in mg/l) present in a given water sample using volumetric method. | Evaluate | K5 |

**Mapping of COs with POs and PSOs (Course Articulation Matrix):**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 1 | 1 | 2 | 3 | - | - | - | - | - | - | - | - | - | - |
| **CO2** | 1 | 1 | 2 | 3 | - | - | - | - | - | - | - | - | - | - |
| **CO3** | 1 | 1 | 2 | 3 | - | - | - | - | - | - | - | - | - | - |
| **CO4** | 1 | 2 | 2 | 3 | - | - | - | - | - | - | - | - | - | - |
| **CO5** | 1 | 2 | 2 | 3 | - | - | - | - | - | - | - | - | - | - |
| **CO6** | 1 | 2 | 2 | 3 | - | - | - | - | - | - | - | - | - | - |
| **AVG.** | 1 | 1.5 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

**University Syllabus :**

**Choose 10 experiments from the following:**

| Unit | Content |
|---|---|
| 1 | Conductometric titration for determination of the strength of a given HCl solution by titration against a standard NaOH solution. |
| 2 | pH- metric titration for determination of strength of a given HCl solution against a standard NaOH solution |
| 3 | Determination of dissolved oxygen present in a given water sample |
| 4 | To determine chloride ion in a given water sample by Argentometric method (using chromate indicator solution) |
| 5 | Determination of surface tension and viscosity |
| 6 | Thin layer chromatography |
| 7 | Ion exchange column for removal of hardness of water |
| 8 | Determination of the rate constant of a reaction |
| 9 | Determination of cell constant and conductance of solutions` |
| 10 | Potentiometry - determination of redox potentials and emfs |
| 11 | Saponification/acid value of an oil |
| 12 | Chemical analysis of a salt |
| 13 | Determination of the partition coefficient of a substance between two immiscible liquids |
| 14 | Adsorption of acetic acid by charcoal |
| 15 | Use of the capillary viscosimeters to the demonstrate of the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg. |

| | |
|---|---|
| **Course Title:Programming for ProblemSolving** | **Code: ES-CS291** |
| **Type of Course: Practical** | **Course Designation: Compulsory** |
| **Semester: 2nd** | **Contact Hours: 4P/week** |
| **Continuous Assessment: 40 Marks** | **Final Exam: 60 Marks** |
| **Writer: Course Coordinator** | **Approved by HoD (convenor of DAB)** |

**COURSE OUTCOMES (COs)**

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

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| **ES-CS291.CO1** | Analyze the problem and formulate algorithms for them. | Analyze | K4 |
| **ES-CS291.CO2** | Translate the algorithms to programs (in C language). | Understand | K2 |
| **ES-CS291.CO3** | Understand the correct syntax of logical expression, branch instruction, iteration, | Understand | K2 |
| **ES-CS291.CO4** | Apply array and pointer to solve problem. | Apply | K3 |
| **ES-CS291.CO5** | Understand the use of , function, recursion. | Understand | K2 |
| **ES-CS291.CO6** | Build analytical skill. | Create | K6 |

**Mapping of COs with POs and PSOs (Course Articulation Matrix):**

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

**University Syllabus :**

**The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given.**

| Unit | Content |
|---|---|
| 1 | Tutorial 1: Problem solving using computers:<br>Lab1: Familiarization with programming environment |
| 2 | Tutorial 2: Variable types and type conversions:<br>Lab 2: Simple computational problems using arithmetic expressions |
| 3 | Tutorial 3: Branching and logical expressions:<br>Lab 3: Problems involving if-then-else structures |
| 4 | Tutorial 4: Loops, while and for loops:<br>Lab 4: Iterative problems e.g., sum of series |
| 5 | Tutorial 5: 1D Arrays: searching, sorting:<br>Lab 5: 1D Array manipulation |
| 6 | Tutorial 6: 2D arrays and Strings<br>Lab 6: Matrix problems, String operations |
| 7 | Tutorial 7: Functions, call by value:<br>Lab 7: Simple functions |
| 8 | Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical integration):<br>Lab 8 and 9: Programming for solving Numerical methods problems |
| 9 | Tutorial 10: Recursion, structure of recursive calls<br>Lab 10: Recursive functions |
| 10 | Tutorial 11: Pointers, structures and dynamic memory allocation<br>Lab 11: Pointers and structures |
| 11 | Tutorial 12: File handling:<br>Lab 12: File operations |

| | |
|---|---|
| **Course Title:Engineering Graphics & Design** | **Code: ES-ME291** |
| **Type of Course: Practical** | **Course Designation: Compulsory** |
| **Semester: 2nd** | **Contact Hours: 1L+4P/week** |
| **Continuous Assessment: 40 Marks** | **Final Exam: 60 Marks** |
| **Writer: Course Coordinator** | **Approved by HoD (convenor of DAB)** |

**COURSE OUTCOMES (COs)**

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

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| **ES-ME291.CO1** | Understand the applications of hand tools and machine tools. | Understand | K2 |
| **ES-ME291.CO2** | Comprehend the safety measures required to be taken while using the tools. | Create | K6 |
| **ES-ME291.CO3** | Select the appropriate tools required to manufacture an object of predetermined shape and size considering least wastage and cost. | Evaluate | K5 |
| **ES-ME291.CO4** | Fabricate components with their own hands. | Create | K6 |
| **ES-ME291.CO5** | Confident on practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes. | Understand | K2 |
| **ES-ME291.CO6** | Produce small devices of their interest by assembling different components. | Create | K6 |

**Mapping of COs with POs and PSOs (Course Articulation Matrix):**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 1 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **CO2** | 1 | - | - | - | - | 1 | - | 1 | - | - | - | - | - | - |
| **CO3** | 1 | - | - | - | - | 1 | - | 1 | 1 | - | - | - | - | - |
| **CO4** | 1 | - | - | - | - | - | 2 | - | 2 | 1 | 1 | - | - | 1 |
| **CO5** | 1 | - | - | - | - | - | 2 | - | 2 | 1 | 1 | 1 | - | - |
| **CO6** | 1 | - | - | - | - | - | 2 | - | 2 | 1 | 2 | 1 | - | 1 |
| **AVG.** | 1 | 0 | 0 | 0 | 0 | 1 | 2 | 1 | 1.75 | 1 | 1.333 | 1 | 0 | 1.00 |

**University Syllabus :**

| Unit | Content |
|---|---|
| 1 | **INTRODUCTION TO ENGINEERING DRAWING** Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Different types of lines and their use; Drawing standards and codes |
| 2 | **LETTERING, DIMENSIONING, SCALES** Plain scale, Diagonal scale and Vernier Scales. |
| 3 | **GEOMETRICAL CONSTRUCTION AND CURVES** Construction of polygons, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid, Involute, Archemedian Spiral. |
| 4 | **PROJECTION OF POINTS, LINES, SURFACES** Principles of Orthographic Projections-Conventions - 1st and 3rd angle projection, Projections of Points and lines inclined to both planes; Projections of planes (Rectangle, pentagon, Hexagon etc.) inclined Planes - Auxiliary Planes. |
| 5 | **PROJECTION OF REGULAR SOLIDS** Regular solids inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale (Cube, Pyramid, Prism, Cylinder, Cone). |
| 6 | **COMBINATION OF REGULAR SOLIDS, FLOOR PLANS** Regular solids in mutual contact with each other like Spheres in contact with cones standing on their base. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. |
| 7 | **ISOMETRIC PROJECTIONS** Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions; |
| 8 | **SECTIONS AND SECTIONAL VIEWS OF RIGHT ANGULAR SOLIDS** Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only) |
| 9 | **OVERVIEW OF COMPUTER GRAPHICS, CUSTOMISATION& CAD DRAWING** listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids]; Set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles; |
| 10 | **ANNOTATIONS, LAYERING & OTHER FUNCTIONS** applying dimensions to objects, applying annotations to drawings; 10 Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer- aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multiview, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling; |
| 11 | **DEMONSTRATION OF A SIMPLE TEAM DESIGN PROJECT** Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerancing; Use of solid- modeling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying colour coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modelling (BIM) |

| | |
|---|---|
| **Course Title:Language Laboratory** | **Code: HM-HU291** |
| **Type of Course: Practical** | **Course Designation: Compulsory** |
| **Semester: 2nd** | **Contact Hours: 2P/week** |
| **Continuous Assessment: 40 Marks** | **Final Exam: 60 Marks** |
| **Writer: Course Coordinator** | **Approved by HoD (convenor of DAB)** |

**COURSE OUTCOMES (COs)**

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

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| **HM-HU291.CO1** | Understand and apply English Speech Sounds for enhancing English Communication | Understand | K2 |
| **HM-HU291.CO2** | Apply English Language Presentation Skill in Academic and in Professional Communication | Apply | K3 |
| **HM-HU291.CO3** | Apply Receptive Skills of English in Academics and in Engineering Profession | Apply | K3 |
| **HM-HU291.CO4** | Apply Writing Skill of English in Academics and in Profession | Apply | K3 |
| **HM-HU291.CO5** | Apply Grammar Skill of English in Academic and in Professional Communication | Apply | K3 |
| **HM-HU291.CO6** | Apply Critical Thinking Skill of English in Academic and in professionional Communication | Apply | K3 |

**Mapping of COs with POs and PSOs (Course Articulation Matrix):**

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

**University Syllabus :**

| Unit | Content |
|---|---|
| 1 | Honing 'Listening Skill' and its sub skills through Language Lab Audio device; |
| 2 | Honing 'Speaking Skill' and its sub skills |
| 3 | Helping them master Linguistic/Paralinguistic features (Pronunciation/Phonetics/ Voice modulation/ Stress/ Intonation/ Pitch &Accent) of connected speech |
| 4 | Honing 'Conversation Skill' using Language Lab Audio –Visual input; Conversational Practice Sessions (Face to Face / via Telephone, Mobile phone & Role Play Mode) |
| 5 | Introducing 'Group Discussion' through audio –Visual input and acquainting them with key strategies for success |
| 6 | G D Practice Sessions for helping them internalize basic Principles (turn- taking, creative intervention, by using correct body language, courtesies & other soft skills) of GD |
| 7 | Honing 'Reading Skills' and its sub skills using Visual / Graphics/ Diagrams /Chart Display/Technical/Non Technical Passages Learning Global / Contextual / Inferential Comprehension; |
| 8 | Honing 'Writing Skill' and its sub skills by using Language Lab Audio –Visual input; Practice Sessions |

**SEMESTER – III THEORY**

| | |
|---|---|
| **Course Title: Analog and Digital Electronics** | **Code: ESC 301** |
| **Type of Course: Theory** | **Course Designation: Compulsory** |
| **Semester: 3rd** | **Contact Hours: 3L/week** |
| **Continuous Assessment: 25 Marks** | **Final Exam: 70 Marks** |

**COURSE OUTCOMES (COs)**

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

| Course Outcome | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| **ESC 301.CO1** | Explain Different Classes of Amplifiers – (Class–A, B, AB and C, power, efficiency; Summarize the basic concepts of Feedback and Oscillation. Demonstrate Phase Shift, Wein Bridge oscillators Astable & Monostable Multivibrators; Schimtt Trigger circuits, 555 Timer. | Explain | K2 |
| **ESC 301.CO2** | Define the basic concepts of Boolean algebra, binary number system. 1's and 2's complement methods, Binary arithmetic. Define the representation in SOP and POS forms; | Define | K1 |
| **ESC 301.CO3** | Demonstrate the concept of Minimization of logic using algebraic and k–map. Build various combinational circuits like Adder and Subtractor circuits, Encoder, Decoder, Comparator, Multiplexer, De–Multiplexer and Parity Generator. | Demonstrate | K2 |
| **ESC 301.CO4** | Explain Sequential Circuits – Basic Flip–flop & Latch, Flip–flops –SR, JK, D, T and JK Master–slave Flip Flops. | Explain | K2 |
| **ESC 301.CO5** | Build Registers (SISO, SIPO, PIPO, PISO) Ring counter, Johnson counter, Synchronous and Asynchronous counters, Mod N Counter. | Build | K6 |
| **ESC 301.CO6** | Explain A/D and D/A conversion techniques – Basic concepts (D/A :R–2–R only A/D: successive approximation ). Explain Logic families– TTL, ECL, MOS and CMOS – basic concepts. | Explain | K2 |

**University Syllabus:**

| Unit | Content | Hrs/Unit |
|---|---|---|
| 1 | Different Classes of Amplifiers – (Class–A, B, AB and C – basic concepts, power, efficiency; Recapitulation of basic concepts of Feedback and Oscillation, Phase Shift, Wein Bridge oscillators Astable & Monostable Multivibrators; Schmitt Trigger circuits, 555 Timer | 9 |
| 2 | Binary Number System & Boolean Algebra (recapitulation); BCD, ASCII, EBDIC, Gray codes and their conversions; Signed binary number representation with 1's and 2's complement methods, Binary arithmetic, Venn diagram, Boolean algebra (recapitulation); Representation in SOP and POS forms; Minimization of logic expressions by algebraic method. Combinational circuits – Adder and Subtractor circuits (half & full adder & subtractor); Encoder, Decoder, Comparator, Multiplexer, De Multiplexer and Parity Generator | 11 |
| 3 | Sequential Circuits – Basic Flip–flop & Latch, Flip–flops –SR, JK, D, T and JK Master–slave Flip Flops, Registers (SISO, SIPO, PIPO, PISO) Ring counter, Johnson counter Basic concept of Synchronous and Asynchronous counters (detail design of circuits excluded), Design of Mod N Counter | 10 |
| 4 | A/D and D/A conversion techniques – Basic concepts (D/A :R–2–R only [2L] A/D: successive approximation [2L]) Logic families– TTL, ECL, MOS and CMOS – basic concepts. (2L) | 6 |

| Course Title: Data Structure & Algorithms | Code: PCC–CS301 |
|---|---|
| Type of Course: Theory | Course Designation: Compulsory |
| Semester: 3rd | Contact Hours: 3L/week |
| Continuous Assessment: 25 Marks | Final Exam: 70 Marks |

**COURSE OUTCOMES (COs)**

On completion of the course students will be able to

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| PCC–CS301.CO1 | Construct algorithms from problems. | Construct | K3 |
| PCC–CS301.CO2 | Understand the basics of abstract data types. | Understand | K2 |
| PCC–CS301.CO3 | Categorize the property of linear and nonlinear data structures. | Categorize | K4 |
| PCC–CS301.CO4 | Learn the use of Tree and graph. | Learn | K3 |
| PCC–CS301.CO5 | Compare different shorting and searching methods. | Compare | K5 |
| PCC–CS301.CO6 | Learn the use of hashing. | Learn | K3 |

**University Syllabus:**

| Unit | Content | Hrs/Unit |
|---|---|---|
| 1 | Introduction: Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time–Space trade off. Searching: Linear Search and Binary Search Technique sand their complexity analysis. | 10 |
| 2 | Stacks and Queues: ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each types of Queues: Algorithms and their analysis. | 9 |
| 3 | Linked Lists: Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis. Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis | 10 |
| 4 | Sorting and Hashing: Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing. Graph: Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis. | 9 |

| Course Title:Discrete Mathematics | Code: PCC–CSIT301 |
|---|---|
| Type of Course: Theory | Course Designation: Compulsory |
| Semester: 3rd | Contact Hours: 3L+1T/week |
| Continuous Assessment: 25 Marks | Final Exam: 70 Marks |

**COURSE OUTCOMES (COs)**

On completion of the course students will be able to

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| PCC–CS301.CO1 | Define fundamental mathematical concepts such as sets, relations, functions, and integers. | Define | K1 |
| PCC–CS301.CO2 | Demonstrate induction hypotheses and simple induction proofs. | Demonstrate | K2 |
| PCC–CS301.CO3 | Solve numbers of possible outcomes of elementary combinatorial processes such as permutations and combinations. | Solve | K3 |
| PCC–CS301.CO4 | Explain a logic sentence in terms of predicates, quantifiers, and logical connectives. | Explain | K2 |
| PCC–CS301.CO5 | Classify algebraic structure for a given mathematical problem. | Classify | K4 |
| PCC–CS301.CO6 | Apply graph theory models of data structures and state machines to solve problems of connectivity and constraint satisfaction. | Apply | K3 |

**University Syllabus:**

| Unit | Content | Hrs/Unit |
|---|---|---|
| 1 | Sets, Relation and Function: Operations and Laws of Sets, Cartesian Products, Binary Relation, Partial Ordering Relation, Equivalence Relation, Image of a Set, Sum and Product of Functions, Bijective functions, Inverse and Composite Function, Size of a Set, Finite and infinite Sets, Countable and uncountable Sets, Cantor's diagonal argument and The Power Set theorem, Schroeder–Bernstein theorem. Principles of Mathematical Induction: The Well– Ordering Principle, Recursive definition, The Division algorithm: Prime Numbers, The Greatest Common Divisor: Euclidean Algorithm, The Fundamental Theorem of Arithmetic | 8 |
| 2 | Basic counting techniques–inclusion and exclusion, pigeon–hole principle, permutation and combination | 5 |
| 3 | Propositional Logic: Syntax, Semantics, Validity and Satisfiability, Basic Connectives and Truth Tables, Logical Equivalence: The Laws of Logic, Logical Implication, Rules of Inference, The use of Quantifiers. Proof Techniques: Some Terminology, Proof Methods and Strategies, Forward Proof, Proof by Contradiction, Proof by Contraposition, Proof of Necessity and Sufficiency | 8 |
| 4 | Algebraic Structures and Morphism: Algebraic Structures with one Binary Operation, Semi Groups, Monoids, Groups, Congruence Relation and Quotient Structures, Free and Cyclic Monoids and Groups, Permutation Groups, Substructures, Normal Subgroups, Algebraic Structures with two Binary Operation, Rings, Integral Domain and Fields. Boolean Algebra and Boolean Ring, Identities of Boolean Algebra, Duality, Representation of Boolean Function, Disjunctive and Conjunctive Normal Form | 7 |
| 5 | Graphs and Trees: Graphs and their properties, Degree, Connectivity, Path, Cycle, Sub Graph, Isomorphism, Eulerian and Hamiltonian Walks, Graph Colouring, Colouring maps and Planar Graphs, Colouring Vertices, Colouring Edges, List Colouring, Perfect Graph, definition properties and Example, rooted trees, trees and sorting, weighted trees and prefix codes, Bi–connected component and Articulation Points, Shortest distances. | 8 |

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|---|---|
| **Course Title: Formal Language & Automata Theory** | **Code: PCC–CSIT302** |
| **Type of Course: Theory** | **Course Designation: Compulsory** |
| **Semester: 3rd** | **Contact Hours: 3L/week** |
| **Continuous Assessment: 25 Marks** | **Final Exam: 70 Marks** |

**COURSE OUTCOMES (COs)**

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

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| PCC–CS302.CO1 | Write a formal notation for strings, languages and machines. | Write | K6 |
| PCC–CS302.CO2 | Design finite automata to accept a set of strings of a language. | Design | K6 |
| PCC–CS302.CO3 | For a given language determine whether the given language is regular or not | Determine | K5 |
| PCC–CS302.CO4 | Design context free grammars to generate strings of context free language. | Design | K6 |
| PCC–CS302.CO5 | Determine equivalence of languages accepted by Push Down Automata and languages generated by context free grammars | Determine | K5 |
| PCC–CS302.CO6 | Write the hierarchy of formal languages, grammars and machines and Distinguish between computability and non–computability and Decidability and undecidability | Write | K6 |

**University Syllabus:**

| Unit | Content | Hrs/Unit |
|---|---|---|
| 1 | Introduction: Alphabet, languages and grammars, productions and derivation, Chomsky hierarchy of languages. | 6 |
| 2 | Regular languages and finite automata: Regular expressions and languages, deterministic finite automata (DFA) and equivalence with regular expressions, nondeterministic finite automata (NFA) and equivalence with DFA, regular grammars and equivalence with finite automata, properties of regular languages, pumping lemma for regular languages, minimization of finite automata) | 7 |
| 3 | Context–free languages and pushdown automata: Context–free grammars (CFG) and languages (CFL), Chomsky and Greibach normal forms, nondeterministic pushdown automata (PDA) and equivalence with CFG, parse trees, ambiguity in CFG, pumping lemma for context–free languages, deterministic push down automata, closure properties of CFLs. | 6 |
| 4 | Context–sensitive languages: Context–sensitive grammars (CSG) and languages, linear bounded automata and equivalence with CSG. | 6 |
| 5 | Turing machines: The basic model for Turing machines (TM), Turing recognizable(recursively enumerable) and Turing–decidable (recursive) languages and their closure properties, variants of Turing machines, nondeterministic TMs and equivalence with deterministic TMs, unrestricted grammars and equivalence with Turing machines, TMsas enumerators | 6 |
| 6 | Undecidability: Church–Turing thesis, universal Turing machine, the universal and diagonalization languages, reduction between languages and Rice s theorem, undecidable problems about languages | 6 |

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|---|---|
| **Course Title: Economics for Engineers (Humanities–II)** | **Code: HSMC 301** |
| **Type of Course: Theory** | **Course Designation: Compulsory** |
| **Semester: 3rd** | **Contact Hours: 3L/week** |
| **Continuous Assessment: 25 Marks** | **Final Exam: 70 Marks** |

**COURSE OUTCOMES (COs)**

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

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| HSMC 301.CO1 | Understand major principles of economic analysis for decision making among alternative courses of action in engineering. | Understand | K2 |
| HSMC 301.CO2 | Apply economic principles to prices and quantities in competitive supply and demand for goods and for money. | Apply | K3 |
| HSMC 301.CO3 | Solve economic problems involving comparison and selection of alternatives by using analytical techniques including benefit–cost ratio and breakeven analysis. | Solve | K3 |
| HSMC 301.CO4 | Evaluate the effect of inflation, deflation and price change with indexes in Engineering Economic Analysis | Evaluate | K5 |
| HSMC 301.CO5 | Analyze the effect of uncertainty in economic analysis by using various concepts like expected value, estimates and simulation | Analyze | K4 |
| HSMC 301.CO6 | Understand the concepts of depreciation and replacement analysis and solve associated problems | Understand | K2 |

| Unit | Content | Hrs/Unit |
|---|---|---|
| 1 | 1. Economic Decisions Making – Overview, Problems, Role, Decision making process.<br>2. Engineering Costs & Estimation – Fixed, Variable, Marginal & Average Costs, Sunk Costs, Opportunity Costs, Recurring And Nonrecurring Costs, Incremental Costs, Cash Costs vs Book Costs, Life–Cycle Costs; Types Of Estimate, Estimating Models – Per Unit Model, Segmenting Model, Cost Indexes, Power–Sizing Model, Improvement & Learning Curve, Benefits. | 9 |

| | | |
|---|---|---|
| 2 | 3. Cash Flow, Interest and Equivalence: Cash Flow – Diagrams, Categories & Computation, Time Value of Money, Debt repayment, Nominal& Effective Interest.<br>4. Cash Flow & Rate of Return Analysis – Calculations, Treatment of Salvage Value, Annual Cash Flow Analysis, Analysis Periods; Internal Rate of Return, Calculating Rate of Return, Incremental Analysis; Best Alternative Choosing an Analysis Method, Future Worth Analysis, Benefit–Cost Ratio Analysis, Sensitivity and Breakeven Analysis. Economic Analysis In The Public Sector –Quantifying And Valuing Benefits & drawbacks. | 9 |
| 3 | 5. Inflation and Price Change – Definition, Effects, Causes, Price Change with Indexes, Types of Index, Composite vs Commodity Indexes, Use of Price Indexes In Engineering Economic Analysis, Cash Flows that inflate at different Rates.<br>6. Present Worth Analysis: End–Of–Year Convention, Viewpoint Of Economic Analysis Studies, Borrowed Money Viewpoint, Effect Of Inflation & Deflation, Taxes, Economic Criteria, Applying Present Worth Techniques, Multiple Alternatives.<br>7. Uncertainty In Future Events – Estimates and Their Use in Economic Analysis, Range Of Estimates, Probability, Joint Probability Distributions, Expected Value, Economic Decision Trees, Risk, Risk vs Return, Simulation, Real Options. | 9 |
| 4 | 8. Depreciation – Basic Aspects, Deterioration & Obsolescence, Depreciation And Expenses, Types Of Property, Depreciation Calculation Fundamentals, Depreciation And Capital Allowance Methods, Straight–Line Depreciation Declining Balance Depreciation, Common Elements Of Tax Regulations For Depreciation And Capital Allowances.<br>9. Replacement Analysis – Replacement Analysis Decision Map, Minimum Cost Life of a New Asset, Marginal Cost, Minimum Cost Life Problems.<br>10. Accounting – Function, Balance Sheet, Income Statement, Financial Ratios Capital Transactions, Cost Accounting, Direct and Indirect Costs, Indirect Cost Allocation. | 9 |

SEMESTER – III

PRACTICAL

| Course Title:Analog and Digital Electronics | Code: ESC 391 |
|---|---|
| Type of Course: Practical | Course Designation: Compulsory |
| Semester: 3rd | Contact Hours: 4P/week |
| Continuous Assessment: 40 Marks | Final Exam: 60 Marks |

**COURSE OUTCOMES (COs)**

On completion of the course students will be able to

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| ESC 391.CO1 | Understand of the fundamental concepts and techniques used in digital electronics. | Understand | K2 |
| ESC 391.CO2 | Understand and examine the structure of various number systems and its application in digital design. | Understand | K2 |
| ESC 391.CO3 | Apply the basic requirements for a design application and propose a cost effective solution of various combinational circuits. | Apply | K3 |
| ESC 391.CO4 | Analyze basic requirements for a design application and propose a cost effective solution of various sequential circuits. | Analyze | K4 |
| ESC 391.CO5 | Identify and prevent various hazards and timing problems in a digital design for developing skill to build, and troubleshoot in digital circuits. | Identify | K3 |
| ESC 391.CO6 | Design and examine the structure of analog circuits and verify its operations. | Design | K6 |

**University Syllabus:**

| Unit | Content |
|---|---|
| 1 | **Analog Electronics**<br>1 Design a Class A amplifier<br>2 Design a Phase–Shift Oscillator<br>3 Design of a Schmitt Trigger using 555 timer |
| 2 | **Digital Electronics**<br>4 Design a Full Adder using basic gates and verify its output / Design a Full Subtractor circuit using basic gates and verify its output.<br>5 Construction of simple Decoder & Multiplexer circuits using logic gates.<br>6 Realization of RS / JK / D flip flops using logic gates<br>7 Design of Shift Register using J–K / D Flip Flop<br>8 Realization of Synchronous Up/Down counter<br>9 Design of MOD– N Counter 10 Study of DAC |

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|---|---|
| **Course Title: Data Structure & Algorithm Lab** | **Code: PCC–CS391** |
| **Type of Course: Practical** | **Course Designation: Compulsory** |
| **Semester: 3rd** | **Contact Hours: 4P/week** |
| **Continuous Assessment: 40 Marks** | **Final Exam: 60 Marks** |

**COURSE OUTCOMES (COs)**

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

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| PCC–CS391.CO1 | Construct algorithms from problems. | Construct | K3 |
| PCC–CS391.CO2 | Understand the basics of Stack, Queue. | Understand | K2 |
| PCC–CS391.CO3 | Categorize the necessarily of linked list and array implementation. | Categorize | K4 |
| PCC–CS391.CO4 | Learn the real life use of Tree and graph. | Learn | K3 |
| PCC–CS391.CO5 | Compare different shorting and searching methods. | Compare | K5 |
| PCC–CS391.CO6 | Understand the implementation mechanism of shorting and searching. | Understand | K2 |

**University Syllabus:**

| Unit | Content |
|---|---|
| 1 | **Linear Data Structure**<br>1 Implementation of array operations<br>2 Stacks and Queues: adding, deleting elements Circular Queue: Adding & deleting elements<br>3 Merging Problem: Evaluation of expressions operations on Multiple stacks & queues:<br>4 Implementation of linked lists: inserting, deleting, inverting a linked list. Implementation of stacks & queues using linked lists<br>5 Polynomial addition, Polynomial multiplication |
| 2 | **Non Linear Data Structure**<br>6 Recursive and Non–recursive traversal of Trees<br>7 Threaded binary tree traversal. AVL tree implementation<br>8 Application of Trees. Application of sorting and searching algorithms<br>9 Hash tables implementation: searching, inserting and deleting, searching & sorting techniques. |

| Course Title: IT Workshop | Code: PCC–CS393 |
|---|---|
| Type of Course: Practical | Course Designation: Compulsory |
| Semester: 3rd | Contact Hours: 4P/week |
| Continuous Assessment: 40 Marks | Final Exam: 60 Marks |

**COURSE OUTCOMES (COs)**

On completion of the course students will be able to

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| PCC–CS393.CO1 | Interpret the basic syntax of python variables, datatypes and operator in python and | Interpret | K2 |
| PCC–CS393.CO2 | Make use of conditional and control flow statement in python fluently. | Make use of | K3 |
| PCC–CS393.CO3 | Define the use of string and list datatype in proficiency level. | Define | K1 |
| PCC–CS393.CO4 | Discover the method to create and manipulation of python data structure like tuple and dictionary. | Discover | K4 |
| PCC–CS393.CO5 | Explain the use of python function and uses of different modules in python. | Explain | K5 |
| PCC–CS393.CO6 | Discuss the concepts of object oriented programming like exception handling. | Discuss | K6 |

**University Syllabus :**

**Programming with Python**

| Unit | Content |
|---|---|
| 1 | Introduction History, Features, Setting up path, Working with Python, Basic Syntax, Variable and Data Types, Operator |
| 2 | Conditional Statements If, If– else, Nested if–else, Looping, For, While, Nested loops |
| 3 | Control Statements Break, Continue, Pass |
| 4 | String Manipulation Accessing Strings, Basic Operations, String slices, Function and Methods |
| 5 | Lists Introduction, Accessing list, Operations, Working with lists, Function and Methods |
| 6 | Tuple Introduction, Accessing tuples, Operations, Working, Functions and Methods |
| 7 | Dictionaries Introduction, Accessing values in dictionaries, Working with dictionaries, Properties |
| 8 | Functions Defining a function, Calling a function, Types of functions, Function Arguments, Anonymous functions, Global and local variables |
| 9 | Modules Importing module, Math module, Random module, Packages, Composition, Input–Output Printing on screen, Reading data from keyboard, Opening and closing file, Reading and writing files, Functions |
| 10 | Exception Handling Exception, Exception Handling, Except clause, Try? finally clause, User Defined Exceptions. |

SEMESTER – IV

THEORY

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|---|---|
| Course Title: Computer Organisation | Code: PCC–CSIT401 |
| Type of Course: Theory | Course Designation: Compulsory |
| Semester: 4th | Contact Hours: 3L/week |
| Continuous Assessment: 25 Marks | Final Exam: 70 Marks |

COURSE OUTCOMES (COs)

On completion of the course students will be able to

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| PCC–CSIT401.CO1 | Illustrate the history of modern computers and the Von Neumann architecture. | Illustrate | K2 |
| PCC–CSIT401.CO2 | Demonstrate basic number systems, Binary numbers, representation of signed and unsigned numbers, Floating point representation. | Demonstrate | K2 |
| PCC–CSIT401.CO3 | Define addressing modes, instruction formats. | Define | K1 |
| PCC–CSIT401.CO4 | Distinguish the organization of various parts of a system memory hierarchy i.e. cache memory , virtual memory etc. | Distinguish | K4 |
| PCC–CSIT401.CO5 | Classify basics of systems topics like, single–cycle (MIPS), multi–cycle (MIPS), parallel, pipelined, superscalar, and RISC/CISC architectures. | Classify | K4 |
| PCC–CSIT401.CO6 | Define different control unit operations and I/O organization. | Define | K1 |

University Syllabus:

| Unit | Content | Hrs/Unit |
|---|---|---|
| 1 | Basic organization of the stored program computer and operation sequence for execution of a program. Role of operating systems and compiler/assembler. Fetch, decode and execute cycle, Concept of operator, operand, registers and storage, Instruction format. Instruction sets and addressing modes. [7L] Commonly used number systems. Fixed and floating point representation of numbers.[1L] | 8 |
| 2 | Overflow and underflow. Design of adders – ripple carry and carry look ahead principles. [3L] Design of ALU. [1L] Fixed point multiplication –Booth's algorithm. [1L] Fixed point division – Restoring and non–restoring algorithms. [2L] Floating point – IEEE 754 standard. [1L] | 8 |
| 3 | Memory unit design with special emphasis on implementation of CPU–memory interfacing. [2L] Memory organization, static and dynamic memory, memory hierarchy, associative memory. [3L] Cache memory, Virtual memory. Data path design for read/write access. [5L] | 10 |
| 4 | Design of control unit – hardwired and microprogrammed control. [3L] Introduction to instruction pipelining. [2L] Introduction to RISC architectures. RISC vs CISC architectures. [2L] I/O operations – Concept of handshaking, Polled I/O, interrupt and DMA. [3L] | 10 |

| Course Title: Computer Networks | Code: PCC– CSIT402 |
|---|---|
| Type of Course: Theory | Course Designation: Compulsory |
| Semester: 4th | Contact Hours: 3L/week |
| Continuous Assessment: 25 Marks | Final Exam: 70 Marks |

**COURSE OUTCOMES (COs)**

On completion of the course students will be able to

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| PCC– CSIT402.CO1 | Describe the fundamental concepts of computer networking, Data Communications System and learn its components. | Describe | K1 |
| PCC– CS IT402.CO2 | Explain the concept of function(s) of each layer of the OSI model and learn about TCP/IP. | Explain | K2 |
| PCC– CS IT402.CO3 | Identify the different types of network topologies, protocols, networking devices and make concepts about their functions within a network. | Identify | K3 |
| PCC– CS IT402.CO4 | Simplify building the skills of subnetting and routing mechanisms. | Simplify | K4 |
| PCC– CS IT402.CO5 | Justify the different system component parts of the network | Justify | K5 |
| PCC– CS IT402.CO6 | Develop an expertise in some specific areas of networking such as the design and learn about maintenance of individual networks | Develop | K6 |

**University Syllabus:**

| Unit | Content | Hrs/Unit |
|---|---|---|
| 1 | Data communication Components: Representation of data and its flow Networks,Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization: Multiplexing – Frequency division, Time division and Wave division, Concepts on spread spectrum. | 9 |
| 2 | Data Link Layer and Medium Access Sub Layer: Error Detection and Error Correction – Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols – Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols –Pure ALOHA, Slotted ALOHA,CSMA/CD,CDMA/CA | 8 |
| 3 | Network Layer: Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols. | 14 |
| 4 | Transport Layer: Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm. | 8 |
| 5 | Application Layer: Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography. | 8 |

| Course Title: Compiler Design | Code: PCC–CSIT403 |
|---|---|
| Type of Course: Theory | Course Designation: Compulsory |
| Semester: 4th | Contact Hours: 3L/week |
| Continuous Assessment: 25 Marks | Final Exam: 70 Marks |

**COURSE OUTCOMES (COs)**

On completion of the course students will be able to

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| PCC–CSIT403.CO1 | Understand and list the different stages in the process of compilation. | Understand | K2 |
| PCC– CSIT403.CO2 | Identify different methods of lexical analysis | Identify | K3 |
| PCC– CSIT403.CO3 | Design top–down and bottom–up parsers | Design | K6 |
| PCC– CSIT403.CO4 | Identify synthesized and inherited attributes | Identify | K3 |
| PCC– CSIT403.CO5 | Develop syntax directed translation schemes | Develop | K3 |
| PCC– CSIT403.CO6 | Develop algorithms to generate code for a target machine | Develop | K6 |

**University Syllabus:**

| Unit | Content | Hrs/Unit |
|---|---|---|
| 1 | Introduction to Compiling [3L] Compilers, Analysis of the source program, The phases of the compiler, Cousins of the compiler | 3 |
| 2 | Lexical Analysis [6L] The role of the lexical analyzer, Tokens, Patterns, 6 Lexemes, Input buffering, Specifications of a token, Recognition of a tokens, Finite automata, From a regular expression to an NFA, From a regular expression to NFA, From a regular expression to DFA, Design of a lexical analyzer generator (Lex). | 6 |
| 3 | Syntax Analysis [9L] The role of a parser, Context free grammars, Writing a grammar, Top down Parsing, Nonrecursive Predictive parsing (LL), Bottom up parsing, Handles, Viable prefixes, Operator precedence parsing, LR parsers (SLR, LALR), Parser generators (YACC). Error Recovery strategies for different parsing techniques. | 9 |
| 4 | Syntax directed translation [5L] Syntax director definitions, Construction of syntax trees, Bottom–up evaluation of S attributed definitions, L attributed definitions, Bottom–up evaluation of inherited attributes. | 5 |
| 5 | Type checking [4L] Type systems, Specification of a simple type checker, Equivalence of type expressions, Type conversions | 4 |
| 6 | Run time environments [5L] Source language issues (Activation trees, Control stack, scope of declaration, Binding of names), Storage organization (Subdivision of run–time memory, Activation records), Storage allocation strategies, Parameter passing (call by value, call by reference, copy restore, call by name), Symbol tables, dynamic storage allocation techniques | 5 |
| 7 | Intermediate code generation [4L] Intermediate languages, Graphical representation, Three–address code, Implementation of three address statements (Quadruples, Triples, Indirect triples). | 4 |
| 8 | Code optimization [5L] Introduction, Basic blocks & flow graphs, Transformation of basic blocks, Dag representation of basic blocks, The principle sources of optimization, Loops in flow graph, Peephole optimization. | 5 |

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|---|---|---|
| 9 | Code generations [4L] Issues in the design of code generator, a simple code generator, Register allocation & assignment | 4 |

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|---|---|
| **Course Title: Design and Analysis of Algorithms** | **Code: PCC–CS404** |
| **Type of Course: Theory** | **Course Designation: Compulsory** |
| **Semester: 4th** | **Contact Hours: 3L/week** |
| **Continuous Assessment: 25 Marks** | **Final Exam: 70 Marks** |

**COURSE OUTCOMES (COs)**

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

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| **PCC–CS404.CO1** | Analyse the complexities of different algorithms. | Analyze | K4 |
| **PCC–CS404.CO2** | Develop the algorithm techniques (example Divide & Conquer, Dynamic Programming etc) to solve different mathematical models. | Develop | K3 |
| **PCC–CS404.CO3** | Illustrate the techniques of Greedy paradigm, Branch and Bound, Backtracking etc and compare and contrast them. | Illustrate | K2 |
| **PCC–CS404.CO4** | Discuss the types of Minimal spanning tree and traversal algorithm with their applications. | Discuss | K6 |
| **PCC–CS404.CO5** | Understand the variations among tractable and intractable problems to introduce polynomial and non–polynomial reduction. | Understand | K2 |
| **PCC–CS404.CO6** | Explain the randomized algorithms and approximation algorithms to illustrate their applications. | Explain | K5 |

**University Syllabus:**

| Unit | Content | Hrs/Unit |
|---|---|---|
| 1 | Introduction: Characteristics of algorithm. Analysis of algorithm: Asymptotic analysis of complexity bounds – best, average and worst–case behavior; Performance measurements of Algorithm, Time and space trade–offs, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters' theorem. | 8 |
| 2 | Fundamental Algorithmic Strategies: Brute–Force, Greedy, Dynamic Programming, Branch and–Bound and Backtracking methodologies for the design of algorithms; Illustrations of these techniques for Problem–Solving, Bin Packing, Knap Sack TSP. Heuristics –characteristics and their application domains. | 8 |
| 3 | Graph and Tree Algorithms: Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm. | 6 |
| 4 | Tractable and Intractable Problems: Computability of Algorithms, Computability classes – P,NP, NP–complete and NP–hard. Cook's theorem, Standard NP–complete problems and Reduction techniques. | 10 |
| 5 | Advanced Topics: Approximation algorithms, Randomized algorithms, Class of problems beyond NP – P SPACE | 6 |

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|---|---|
| **Course Title: Biology** | **Code: BSC 401** |
| **Type of Course: Theory** | **Course Designation: Compulsory** |
| **Semester: 4th** | **Contact Hours: 2L+1T/week** |
| **Continuous Assessment: 25 Marks** | **Final Exam: 70 Marks** |

**COURSE OUTCOMES (COs)**

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

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| **BSC 401.CO1** | Describe with examples the biological observations lead to major discoveries | Describe | K1 |
| **BSC 401.CO2** | Explain the classification of kingdom and building blocks of life, classification at cellular, energy and excretory level, habitat, study of model organisms, explain techniques of biophysics to study biological phenomena, cancer diagnosis and treatment. | Explain | K2 |
| **BSC 401CO3** | Identify DNA as genetic material in the molecular basis of information transfer | Identify | K3 |
| **BSC 401.CO4** | Analyze biological processes at the reductionistic level. | Analyze | K4 |
| **BSC 401.CO5** | Apply thermodynamic principles to biological systems. | Apply | K3 |
| **BSC 401.CO6** | Identify microorganism | Identify | K3 |

**University Syllabus:**

| Unit | Content | Hrs/Unit |
|---|---|---|
| 1 | To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology? Discuss how biological observations of 18th Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. These examples will highlight the fundamental importance of observations in any scientific inquiry. | 2 |
| 2 | The underlying criterion, such as morphological, biochemical or ecological be highlighted. Hierarchy of life forms at phenomenological level. A common thread weaves this hierarchy Classification. Discuss classification based on (a) cellularity– Unicellular or multicellular (b) ultrastructure– prokaryotes or eucaryotes. (c) energy and Carbon utilisation –Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricoteliec, ureotelic (e) Habitata– acquatic or terrestrial (e) Molecular taxonomy– three major kingdoms of life. A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. E.coli, S.cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M. musculus | 3 |
| 3 | To convey that "Genetics is to biology what Newton's lawsaretoPhysicalSciences" Mendel's laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be give not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring. Concepts of | 4 |

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|---|---|---|
| | recessiveness and dominance. Concept of mapping of phenotype to genes. Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics. | |
| 4 | Biomolecules: To convey that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine Molecules of life. In this context discuss monomeric units and polymeric structures. Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA.Two carbon units and lipids | 4 |
| 5 | Enzymes: To convey that without catalysis life would not have existed on earth Enzymology: How to monitor enzyme catalysed reactions. How does an enzyme catalyse reactions? Enzyme classification. Mechanism of enzyme action. Discuss at least two examples. Enzyme kinetics and kinetic parameters. Why should we know these parameters to understand biology? RNA catalysis. | 4 |
| 6 | Information Transfer:The molecular basis of coding and decoding genetic information is universal Molecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA structure– from single stranded to double helix to nucleosomes. Concept of genetic code. Universality and degeneracy of genetic code. Define gene in terms of complementation and Recombination | 4 |
| 7 | Macromolecular analysis: How to analyse biological processes at the reductionist level Proteins– structure and function. Hierarch in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements | 5 |
| 8 | Metabolism: The fundamental principles of energy transactions are the same in physical and biological world. Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergoinc reactions. Concept of Keqand its relation to standard free energy. Spontaneity. ATP as an energy currency. This should include the breakdown of glucose to CO2 + H2O（Glycolysis and Krebs cycle） and synthesis of glucose from CO2 and H2O （Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy charge | 4 |
| 9 | Microbiology Concept of single celled organisms. Concept of species and strains. Identification and classification of microorganisms. Microscopy. Ecological aspects of single celled organisms. Sterilization and media compositions. Growth kinetics. | 3 |

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|---|---|
| **Course Title: Environmental Sciences** | **Code: MC–401** |
| **Type of Course: Theory** | **Course Designation: Compulsory** |
| **Semester: 4th** | **Contact Hours: 1L/week** |
| **Continuous Assessment: 25 Marks** | **Final Exam: 70 Marks** |
| **Course Coordinator :** | **Approved by HoD (convenor of DAB)** |

**COURSE OUTCOMES (COs)**

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

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| **BSC 401.CO1** | Resolve different open–ended problems related to air pollution acquiring the detailed knowledge about source, effect and mechanism of the pollution. | Resolve | K3 |
| **BSC 401.CO2** | Solve various societal problems related to land pollution after detailed understanding about source, effect and mechanism of the pollution | Solve | K3 |
| **BSC 401CO3** | Conceive the basic of the need of natural resource management, environmental protection and population control. Extend the knowledge as well as the consciousness related to environmental issues to the society considering the related laws, acts and legislations | Conceive | K2 |
| **BSC 401.CO4** | Acquire skills for scientific problem–solving related to air, water, noise& land pollution. | Acquire | K1 |
| **BSC 401.CO5** | Determine the issues related to noise pollution after studying the existing situation in detail. | Determine | K5 |
| **BSC 401.CO6** | Develop awareness about the geographical feature of the country considering biodiversity and the variety of ecological systems present in the nature. | Develop | K6 |

**University Syllabus:**

| Unit | Content | Hrs/Unit |
|---|---|---|
| 1 | Basic ideas of environment, basic concepts, man, society & environment, their interrelationship (1L) Mathematics of population growth and associated problems, Importance of population study in environmental engineering, definition of resource, types of resource, renewable, non- renewable, potentially renewable, effect of excessive use vis-à-vis population growth, Sustainable Development. (2L) Materials balance: Steady state conservation system, steady state system with non-conservative pollutants, step function. (1L) Environmental degradation: Natural environmental Hazards like Flood, earthquake, Landslide-causes, effects and control/management; Anthropogenic degradation like Acid rain-cause, effects and control. Nature and scope of Environmental Science and Engineering. (2L) | 6 |
| 2 | Elements of ecology: System, open system, closed system, definition of ecology, species, population, community, definition of ecosystem- components types and function. (1L) Structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, Mangrove ecosystem (special reference to Sundar ban); Food chain [definition and one example of each food chain], Food web.( 2L) Biogeochemical Cycle- definition, significance, flow chart of different cycles with only elementary reaction [Oxygen, carbon, Nitrogen, Phosphate, Sulphur].(1L) Biodiversity- types, importance, Endemic species, Biodiversity Hot-spot, Threats to biodiversity, Conservation of biodiversity.( 2L) | 6 |
| 3 | Atmospheric Composition: Troposphere, Stratosphere, Mesosphere, Thermosphere, Tropopause and Mesopause. (1L) Energy balance: Conductive and Convective heat transfer, radiation heat transfer, simple global temperature model [Earth as a black body, earth as albedo], Problems.( 1L) Green house effects: Definition, impact of greenhouse gases on the global climate and consequently on sea water level, agriculture and marine food. Global warming and its consequence, Control of Global warming. Earth's heat budget.(1L) Lapse rate: Ambient lapse rate Adiabatic lapse rate, atmospheric stability, temperature inversion (radiation inversion).(2L) Atmospheric dispersion: Maximum mixing depth, ventilation coefficient, effective stack height, smokestack plumes and Gaussian plume model.(2L) Definition of pollutants and contaminants, Primary and secondary pollutants: emission standard, criteria pollutant. Sources and effect of different air pollutants- Suspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur, particulate, PAN. (2L) Smog, Photochemical smog and London smog. Depletion Ozone layer: CFC, destruction of ozone layer by CFC, impact of other green-house gases, effect of ozone modification. (1L) Standards and control measures: Industrial, commercial and residential air quality standard, control measure (ESP. cyclone separator, bag house, catalytic converter, scrubber (ventury), Statement with brief reference). (1L) | 11 |
| 4 | Hydrosphere, Hydrological cycle and Natural water. Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, thermal application, heavy metals, pesticides, volatile organic compounds. (2L) River/Lake/ground water pollution: River: DO, 5- day BOD test, Seeded BOD test, BOD reaction rate constants, Effect of oxygen demanding wastes on river [deoxygenation, reaeration], COD, Oil, Greases, pH. (2L) Lake: Eutrophication [Definition, source and effect]. (1L) Ground water: Aquifers, hydraulic gradient, ground water flow (Definition only)(1L) Standard and control: Waste water standard [BOD, COD, Oil, Grease], Water Treatment system [coagulation and flocculation, sedimentation and filtration, disinfection, hardness and alkalinity, softening] Waste water treatment system, primary and secondary treatments [Trickling filters, rotating biological contractor, Activated sludge, sludge treatment, oxidation ponds] tertiary treatment definition. (2L) Water pollution due to the toxic elements and their biochemical effects: Lead, Mercury, Cadmium, and Arsenic (1L) | 9 |
| 5 | Lithosphere; Internal structure of earth, rock and soil (1L) Solid Waste: Municipal, industrial, commercial, agricultural, domestic, pathological and hazardous solid wastes; Recovery and disposal method- Open dumping, Land filling, incineration, composting, recycling. Solid waste | 3 |

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|---|---|---|
| | management and control (hazardous and biomedical waste).(2L) | |
| 6 | Definition of noise, effect of noise pollution, noise classification [Transport noise, occupational noise, neighbourhood noise] (1L) Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noise level, L10 (18hr Index) ,n Ld.Noise pollution control.(1L) | 3 |
| 7 | Environmental impact assessment, Environmental Audit, Environmental laws and protection act of India, Different international environmental treaty/ agreement/ protocol. (2L) | 2 |

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|---|---|
| **Course Title: Introduction to Industrial Management (Humanities III)** | **Code: HSMC-401** |
| **Type of Course: Theory** | **Course Designation: Compulsory** |
| **Semester: 4th** | **Contact Hours: 3L/week** |
| **Continuous Assessment: 25 Marks** | **Final Exam: 70 Marks** |

**COURSE OUTCOMES (COs)**

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

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| HSMC-401.CO1 | Recall the concepts of Accounting and Recognize different systems used in industrial applications. | Recall | K1 |
| HSMC-401.CO2 | Discuss on the design of appropriate accounting tool required for real life problems. | Discuss | K1 |
| HSMC-401.CO3 | Apply and demonstrate the use of Economical concepts. | Apply | K3 |

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|---|---|---|---|
| HSMC–401.CO4 | Analyze and Simulate a sequential accounting tool for a system or process appropriate for required accuracy. | Analyze | K4 |
| HSMC–401.CO5 | Design a sequential economic policy that can work according to the required specifications. | Design | K6 |
| HSMC–401.CO6 | Justify a specific accounting technique for an specific purpose. | Justify | K5 |

**University Syllabus :**

| Unit | Content | Hrs/Unit |
|---|---|---|
| 1 | **Introduction System–** concept, definition, types, parameters, variables and behavior. Management – definition and functions. Organization structure: i. Definition. ii. Goals. iii. Factors considered in formulating structure. iv. Types. v. Advantages and disadvantages. vi. Applications. Concept, meaning and importance of division of labor, scalar & functional processes, span of control, delegation of authority, centralization and decentralization in industrial management. Organizational culture and climate – meaning, differences and factors affecting them. Moral–factors affecting moral. Relationship between moral and productivity. Job satisfaction– factors influencing job satisfaction. Important provisions of factory act and labor laws. | 6 |
| 2 | **Critical Path Method (CPM) and Programme Evaluation Review Technique (PERT):** 2.1 CPM & PERT–meaning, features, difference, applications. 2.2 Understand different terms used in network diagram. Draw network diagram for a real life project containing 10–15 activities, computation of LPO and EPO.(Take minimum three examples). Determination of critical path on network. Floats, its types and determination of floats. Crashing of network, updating and its applications. | 8 |
| 3 | **Materials Management:** Material management–definition, functions, importance, relationship with other departments. Purchase – objectives, purchasing systems, purchase procedure, terms and forms used in purchase department. Storekeeping– functions, classification of stores as centralized and decentralized with their advantages, disadvantages and application in actual practice. Functions of store, types of records maintained by store, various types and applications of storage equipment, need and general methods for codification of stores. Inventory control: i. Definition. ii. Objectives. iii. Derivation for expression for Economic Order Quantity (EOQ) and numeric examples. iv. ABC analysis and other modern methods of analysis. v. Various types of inventory models such as Wilson's inventory model, replenishment model and two bin model. (Only sketch and understanding, no derivation.). 3.6 Material Requirement Planning (MRP)– concept, applications and brief details about software packages available in market. | 6 |
| 4 | **Production planning and Control (PPC):** Types and examples of production. PPC : i. Need and importance. ii. Functions. iii. Forms used and their importance. iv. General approach for each type of production. Scheduling– meaning and need for productivity and utilisation. Gantt chart– Format and method to prepare. Critical ratio scheduling– method and numeric examples. Scheduling using Gantt Chart (for at least 5–7 components having 5–6 machining operations, with processes, setting and operation time for each component and process, resources available, quantity and other necessary data), At least two examples. 4.7 Bottlenecking– meaning, effect and ways to reduce. | 8 |
| 5 | **Value Analysis (VA) and Cost Control:** 5.1 VA–definition, terms used, process and importance. VA flow diagram. DARSIRI method of VA. Case study of VA–at least two. Waste–types, sources | 4 |

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|---|---|---|
| | and ways to reduce them. Cost control–methods and important guide lines. | |
| 6 | **Recent Trends in IM:** ERP (Enterprise resource planning) – concept, features and applications. Important features of MS Project. Logistics– concept, need and benefits. Just in Time (JIT)– concept and benefits. Supply chain management–concept and benefits. | 4 |

## SEMESTER – IV PRACTICAL

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|---|---|
| **Course Title: Design & Analysis Algorithm Lab** | **Code: PCC–CS494** |
| **Type of Course: Practical** | **Course Designation: Compulsory** |
| **Semester: 4th** | **Contact Hours: 4P/week** |
| **Continuous Assessment: 40 Marks** | **Final Exam: 60 Marks** |

**COURSE OUTCOMES (COs)**

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

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| PCC–CS494.CO1 | Analyse different types of applications of Divide & Conquer techniques | Analyze | K4 |
| PCC–CS494.CO2 | Understanding to implement Dynamic Programming techniques | Understand | K2 |
| PCC–CS494.CO3 | Examine to implement knapsack, Job sequencing with deadlines, Prim's and Kruskal's algorithms by using greedy method | Examine | K4 |
| PCC–CS494.CO4 | Discuss the implementation of the N–Queen and Graph Coloring Problem by using Backtracking | Discuss | K6 |
| PCC–CS494.CO5 | Develop 15 Puzzle problem by using Branch & Bound | Develop | K3 |
| PCC–CS494.CO6 | Explain the way of implementation of BFS and DFS by using Graph Traversal Algorithms | Explain | K2 |

**University Syllabus:**

| Unit | Content |
|---|---|
| 1 | **Divide and Conquer:**<br>1 Implement Binary Search using Divide and Conquer approach Implement Merge Sort using Divide and Conquer approach<br>2 Implement Quick Sort using Divide and Conquer approach Find Maximum and Minimum element from a array of integer using Divide and Conquer approach<br>3 Find the minimum number of scalar multiplication needed for chain of matrix<br>4 Implement all pair of Shortest path for a graph (Floyed– Warshall Algorithm) Implement Traveling Salesman Problem<br>5 Implement Single Source shortest Path for a graph ( Dijkstra , Bellman Ford Algorithm |
| 2 | **Brunch and Bound:**<br>6 Implement 15 Puzzle Problem |
| 3 | **Backtracking:**<br>7 Implement<br>8 Queen problem 8 Graph Coloring Problem Hamiltonian Problem |
| 4 | **Greedy method**<br>9 Knapsack Problem Job sequencing with deadlines<br>10 Minimum Cost Spanning Tree by Prim's Algorithm Minimum Cost Spanning Tree by Kruskal's Algorithm |
| 5 | **Graph Traversal Algorithm:**<br>11 Implement Breadth First Search (BFS) Implement Depth First Search (DFS) |

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|---|---|
| **Course Title: Computer Organization Lab** | **Code: PCC–CSIT491** |
| **Type of Course: Practical** | **Course Designation: Compulsory** |
| **Semester: 4th** | **Contact Hours: 4P/week** |
| **Continuous Assessment: 40 Marks** | **Final Exam: 60 Marks** |

**COURSE OUTCOMES (COs)**

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

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| **PCC–CSIT491.CO1** | Understand the behaviour of logic gates. | Understand | K2 |
| **PCC– CSIT491.CO2** | Design combinational circuits for basic components of computer system and Applications. | Design | K6 |
| **PCC– CSIT491.CO3** | Analyze the operational behaviour and applications of various flip–flop. | Analyze | K4 |
| **PCC– CSIT491.CO4** | Implement Arithmetic logic units and different types of memory blocks. | Implement | K3 |
| **PCC– CSIT491.CO5** | Design to cascade multiple RAM chips for vertical and horizontal expansion. | Design | K6 |
| **PCC– CSIT491.CO6** | Implement Carry–Look–Ahead Adder and BCD adder circuit . | Implement | K3 |

**University Syllabus:**

| Unit | Content |
|---|---|
| 1 | Familiarity with IC–chips: a) Multiplexer, b) Decoder, c) Encoder b) Comparator Truth Table verification and clarification from Data–book. |
| 2 | Design an Adder/Subtractor composite unit. |
| 3 | Design a BCD adder. |
| 4 | Design of a 'Carry–Look–Ahead' Adder circuit. |
| 5 | Use a multiplexer unit to design a composite ALU |
| 6 | Use ALU chip for multibit arithmetic operation |
| 7 | Implement read write operation using RAM IC |
| 8 | (a) & (b) Cascade two RAM ICs for vertical and horizontal expansion. |

SEMESTER – V

THEORY

| Course Title: Software Engineering | Code: ESC501 |
|---|---|
| Type Of Course: Theory | Course Designation: Compulsory |
| Semester: 5th | Contact Hours: 3L/week |
| Continuous Assessment: 25 Marks | Final Exam: 70 Marks |

**COURSE OUTCOMES (COs)**

On completion of the course students will be able to

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| ESC501.CO1 | Identify and define the various phases of lifecycle for a given project and the appropriate process model depending on the user requirements in order to develop a cost effective software product. | Identify | K1 |
| ESC501.CO2 | Distinguish between a structure chart and a flow chart and Identify the activities carried out during transform. | Distinguish | K4 |
| ESC501.CO3 | Choose between the coding style(structured or OO)and Perform Code review, Code analysis, build process | Choose | K3 |
| ESC501.CO4 | Judge appropriate software testing techniques to the quality of a software product at modules, integration, and system granularity levels. | Judge | K5 |
| ESC501.CO5 | Apply the principles, processes and main knowledge areas for Software Project Management | Apply | K3 |
| ESC501.CO6 | Design different types of UML diagram with knowledge when and why use a particular type of dig based on the software product requirements | Design | K6 |

**University Syllabus:**

| Unit | Content | Hrs/Unit |
|---|---|---|
| 1 | Overview of System Analysis & Design , Business System Concept, System Development Life Cycle, Waterfall Model , Spiral Model, Feasibility Analysis, Technical Feasibility, Cost– Benefit Analysis, COCOMO model. [10L] | 10 |
| 2 | System Design – Context diagram and DFD, Problem Partitioning, Top–Down And Bottom–Up design; Decision tree, decision table and structured English; Functional vs. Object– Oriented approach. [5L] | 5 |
| 3 | Coding & Documentation – Structured Programming, OO Programming, Information Hiding, Reuse, System Documentation. [4L] Testing – Levels of Testing, Integration Testing, Test case Specification, Reliability Assessment, Validation & Verification 12 Metrics, Monitoring & Control. [8L] | 12 |
| 4 | Software Project Management – Project Scheduling, Staffing, Software Configuration Management, Quality Assurance, Project Monitoring. [7L] | 7 |
| 5 | Static and dynamic models, why modeling, UML diagrams: Class diagram, interaction diagram: collaboration diagram, sequence diagram, state chart diagram, activity diagram, implementation diagram. [10 L] | 10 |

| Course Title:Computer Architecture | Code: PCC–CSIT501 |
|---|---|
| Type of Course: Theory | Course Designation: Compulsory |
| Semester: 5th | Contact Hours: 3L/week |
| Continuous Assessment: 25 Marks | Final Exam: 70 Marks |

**COURSE OUTCOMES (COs)**

On completion of the course students will be able to

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| PCC–CSIT501.CO1 | Understand The basic of Computer architecture | Understand | K2 |
| PCC–CSIT501.CO2 | Discuss the Pipelining technique of Computer architecture | Discuss | K6 |
| PCC–CSIT501.CO3 | Illustrate Different memory management technology | Illustrate | K2 |
| PCC–CSIT501.CO4 | Develop The Instruction level parallelism | Develop | K3 |
| PCC–CSIT501.CO5 | Analyze array and vector processors. | Analyze | K4 |
| PCC–CSIT501.CO6 | Explain the multiprocessor architecture and different taxonomy | Explain | K5 |

**University Syllabus:**

| Unit | Content | Hrs/Unit |
|---|---|---|
| 1 | Introduction: Review of basic computer architecture (Revisited), Quantitative techniques in computer design, measuring and reporting performance. (3L) Pipelining: Basic concepts, instruction and arithmetic pipeline, data hazards, control hazards and structural hazards, techniques for handling hazards. Exception handling. Pipeline optimization techniques; Compiler techniques for improving performance. (9L) | 12 |
| 2 | Hierarchical memory technology: Inclusion, Coherence and locality properties; Cache memory organizations, Techniques for reducing cache misses; Virtual memory organization, mapping and management techniques, memory replacement policies. (8L) | 8 |
| 3 | Instruction–level parallelism: basic concepts, techniques for increasing ILP, superscalar, super– pipelined and VLIW processor architectures. Array and | 6 |
| 4 | Multiprocessor architecture: taxonomy of parallel architectures; Centralized shared– memory architecture: synchronization, memory consistency, interconnection networks. Distributed shared–memory architecture. Cluster computers.(8L) Non von Neumann architectures: data flow computers, reduction computer architectures, systolic architectures. (4L) | 7 |

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|---|---|
| **Course Title: Operating Systems** | **Code: PCC–CS502** |
| **Type Of Course: Theory** | **Course Designation: Compulsory** |
| **Semester: 5th** | **Contact Hours: 3L/week** |
| **Continuous Assessment: 25 Marks** | **Final Exam: 70 Marks** |

**COURSE OUTCOMES (COs)**

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

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| **PCC–CS502.CO1** | Demonstrate the concepts of Operating System Services, System calls, structure and types. | Demonstrate | K2 |
| **PCC–CS502.CO2** | Discuss processes and threads for multiprogramming and multi–threading. | Discuss | K6 |
| **PCC–CS502.CO3** | Develop algorithms for process scheduling for a given specification of CPU utilization, Throughput, Turnaround Time, Waiting Time, Response | Develop | K3 |
| **PCC–CS502.CO4** | Explain algorithmic solutions to process synchronization problems for Inter–Process communication | Explain | K5 |
| **PCC–CS502.CO5** | Analyse the necessary conditions for Deadlock avoidance and prevention to solve them. | Analyze | K6 |
| **PCC–CS502.CO6** | Explain Memory management, Virtual Memory, I/O Hardware, File and Disk Management system. | Explain | K2 |

**University Syllabus:**

| Unit | Content | Hrs/Unit |
|---|---|---|
| 1 | Introduction: Generations Concept of of Operating Operating systems, Systems, Types of 3 Operating Systems, OS Services, System Calls, Structure of an OS – Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine. Case study on UNIX and WINDOWS Operating System. | 3 |
| 2 | Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads, Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre–emptive and Non pre–emptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling:RM and EDF. | 10 |

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|---|---|---|
| 3 | Inter–process Communication: Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem. | 5 |
| 4 | Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery. | 5 |
| 5 | Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation– Fixed and variable partition– Internal and External fragmentation and Compaction; Paging: Principle of operation –Page allocation Hardware support for paging, Protection and sharing, Disadvantages of paging. Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault , Working Set , Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used(LRU). | 8 |
| 6 | I/O Hardware: I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software, Secondary–Storage Structure: Disk structure, Disk scheduling algorithms File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free–space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency andperformance. Disk Management: Disk structure, Disk scheduling – FCFS, SSTF, SCAN, C–SCAN, Disk reliability, Disk formatting, Boot–block, Bad blocks. | 6 |

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|---|---|
| **Course Title: Advance Programming for Real Life Applications** | **Code: PCC–CSIT502** |
| **Type Of Course: Theory** | **Course Designation: Compulsory** |
| **Semester: 5th** | **Contact Hours: 3L/week** |
| **Continuous Assessment: 25 Marks** | **Final Exam: 70 Marks** |

**COURSE OUTCOMES (COs)**

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

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| **PCC–CSIT502.CO1** | Understand advanced Python programming concepts, including memory management, metaprogramming techniques, concurrency, and parallelism, to enhance software efficiency and maintainability. | Understand | K2 |
| **PCC–CSIT502.CO2** | Apply object–oriented programming (OOP) principles such as inheritance, polymorphism, encapsulation, and abstraction to design modular, scalable, and reusable software solutions. | Apply | K3 |
| **PCC–CSIT502.CO3** | Implement well–established software design patterns, including creational, structural, and behavioral patterns, to solve complex real–world software development problems. | Implement | K4 |
| **PCC–CSIT502.CO4** | Analyze software architecture and optimization strategies by profiling code, debugging efficiently, and integrating unit testing to improve code maintainability and scalability. | Analyze | K5 |
| **PCC–CSIT502.CO5** | Develop real–world software applications using Python, OOP principles, and design patterns, ensuring performance optimization, maintainability, and adherence to industry best practices. | Develop | K6 |

**University Syllabus:**

| Unit | Content | Hrs/Unit |
|---|---|---|
| 1 | **Advanced Python Programming Concepts**<br>– **Memory Management in Python**: Understanding reference counting, garbage collection mechanisms, memory leaks, and best practices for efficient memory utilization.<br>– **Metaprogramming**: Using decorators, metaclasses, and dynamic code execution techniques to write flexible and reusable code.<br>– **Iterators, Generators, and Coroutines**: Implementing iterators for custom object traversal, creating efficient data pipelines using generators, and leveraging coroutines for asynchronous programming.<br>– **Concurrency and Parallelism**: Exploring multi–threading, multiprocessing, and AsyncIO for writing high–performance, scalable applications that efficiently utilize CPU and I/O operations. | 6 |
| 2 | **Object–Oriented Programming (OOP) in Python**<br>– **Core OOP Principles**: In–depth study of classes, objects, constructors, destructors, and the principles of inheritance, polymorphism, encapsulation, and abstraction.<br>– **Magic Methods and Operator Overloading**: Implementing dunder methods like __str__, __repr__, __eq__, and overloading arithmetic/logical operators to customize object behavior.<br>– **Abstract Classes and Interfaces**: Understanding and implementing abstract classes, interfaces, and multiple inheritance for designing extensible and modular applications.<br>– **SOLID Principles**: Applying industry–standard best practices (Single Responsibility, Open–Closed, Liskov Substitution, Interface Segregation, Dependency Inversion) to write clean, maintainable, and scalable code. | 10 |

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|---|---|---|
| 3 | **Software Design Patterns in Python**<br>– **Creational Design Patterns**: Implementing Singleton, Factory, and Builder patterns to manage object creation efficiently.<br>– **Structural Design Patterns**: Using Adapter, Decorator, and Proxy patterns to enhance flexibility in application architecture.<br>– **Behavioral Design Patterns**: Applying Observer, Strategy, and Command patterns for improved interaction between objects. | 8 |
| 4 | **Real–Life Application Development Using Python**<br>– **Web Development**: Building scalable backend applications using Flask and FastAPI, including database integration and API handling.<br>– **Data Processing and Analysis**: Using Pandas and NumPy for real–time data manipulation, visualization, and analytics in scientific computing and business intelligence applications.<br>– **API Development and Integration**: Implementing RESTful APIs, GraphQL, and third–party API integrations to enable data exchange between software components.<br>– **GUI Development**: Designing interactive user interfaces using Tkinter and PyQt for desktop applications. | 12 |
| 5 | **Performance Optimization and Code Quality**<br>– **Code Profiling and Optimization**: Using profiling tools like cProfile, line_profiler, and memory_profiler to analyze execution time, memory usage, and optimize performance bottlenecks.<br>– **Debugging and Logging Best Practices**: Leveraging Python's built–in debugging tools (pdb) and logging module for efficient debugging and traceability in large applications.<br>– **Writing Maintainable and Scalable Code**: Understanding modular programming, documentation best practices, and refactoring strategies for sustainable software development.<br>– **Testing Strategies**: Implementing unit testing, integration testing, and test–driven development (TDD) using the unittest and pytest frameworks. | 6 |
| 6 | **Understand Case Studies and Industry Applications**<br>– **Real–World Use Cases of OOP and Design Patterns**: Exploring case studies from domains like e–commerce, banking, healthcare, and logistics where OOP and design patterns play a crucial role.<br>– **Application Development in Finance, Healthcare, and IoT**: Developing financial modeling applications, predictive healthcare analytics, and IoT–based automation solutions.<br>– **Industry Best Practices for Scalable Software Solutions**: Understanding CI/CD pipelines, containerization with Docker, and deployment strategies in enterprise software development. | 6 |

| Course Title: Theory of Computation | Code: PECIT–501A |
|---|---|
| Type Of Course: Theory | Course Designation: Compulsory |
| Semester: 5th | Contact Hours: 3L/week |
| Continuous Assessment: 25 Marks | Final Exam: 70 Marks |

**COURSE OUTCOMES (COs)**

On completion of the course students will be able to

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| PECIT–501A.CO1 | Define a system and recognize the behavior of a system. Minimize a system and compare different systems. | Define | K2 |
| PECIT–501A.CO2 | Convert Finite Automata to Regular Expression. Check equivalence between Regular Linear Grammar and Finite Automata. | Convert | K3 |
| PECIT–501A.CO3 | Minimize Context–Free Grammar and verify the equivalence of CFL and PDA. | Minimize | K4 |
| PECIT–501A.CO4 | Design Turing Machines and explore their computational capabilities. | Design | K6 |
| PECIT–501A.CO5 | Define a system and recognize the behavior of a system. Minimize a system and compare different systems. | Define | K2 |

**University Syllabus:**

| Unit | Content | Hrs/Unit |
|---|---|---|
| 1 | **Fundamentals of Finite Automata**<br>– Basic definition of sequential circuits, block diagrams, mathematical representation, transition table, and transition diagram (relating Automata concepts to sequential circuits).<br>– Design of sequence detectors. Introduction to the finite state model.<br>– Finite State Machine (FSM): Definitions, capabilities, state equivalence, and kth–equivalent concepts.<br>– Merger graph, merger table, compatibility graph.<br>– Finite memory definiteness, testing table, and testing graph.<br>– Deterministic Finite Automaton (DFA) and Non–Deterministic Finite Automaton (NFA).<br>– Transition diagrams and language recognizers.<br>– NFA with ε–transitions, significance, acceptance of languages.<br>– Conversions and Equivalence: Equivalence between NFA with and without ε–transitions.<br>– NFA to DFA conversion.<br>– Minimization of FSM, Equivalence between two FSMs, Limitations of FSM.<br>– Application of finite automata.<br>– Finite Automata with output: Moore and Mealy machines. | 13 |
| 2 | **Regular Languages and Grammar Formalism**<br>– Regular Sets.<br>– Regular Expressions and Identity Rules.<br>– Arden's Theorem: Statement and Proof.<br>– Constructing Finite Automata from Regular Expressions.<br>– Regular Strings accepted by NFA/DFA.<br>– Pumping Lemma for Regular Sets.<br>– Closure properties of regular sets (proofs not required).<br>– Grammar Formalism: Regular Grammars— Right Linear and Left Linear Grammars.<br>– Equivalence between Regular Linear Grammar and Finite Automata.<br>– Interconversion of Regular Grammar and Finite Automata. | 9 |

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|---|---|---|
| | – Introduction to Context–Free Grammar (CFG).<br>– Derivation trees, sentential forms. Right–most and left–most derivations of strings (concept only). | |
| 3 | **Context–Free Grammars and Pushdown Automata (PDA)**<br>– Context–Free Grammars (CFG) and Ambiguity in CFG.<br>– Minimization of Context–Free Grammars.<br>– Chomsky Normal Form (CNF) and Greibach Normal Form (GNF).<br>– Pumping Lemma for Context–Free Languages (CFL).<br>– Enumeration of properties of CFL (proofs omitted).<br>– Closure properties of CFL.<br>– Ogden's Lemma and its applications.<br>– Pushdown Automata (PDA): Definition and characteristics.<br>– Acceptance of CFL using PDA: Acceptance by final state and acceptance by empty stack (and their equivalence).<br>– Equivalence of CFL and PDA, interconversion (proofs not required).<br>– Introduction to Deterministic Context–Free Languages (DCFL) and Deterministic PDA (DPDA). | 9 |
| 4 | **Turing Machines and Computability**<br>– Introduction to Turing Machines (TM): Definition and conceptual model.<br>– Designing simple Turing Machines.<br>– Computable functions and recursive definitions.<br>– Church's Hypothesis and Counter Machines.<br>– Types of Turing Machines (proofs not required).<br>– Universal Turing Machine and the Halting Problem. | 5 |

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| **Course Title: Signals & Systems** | **Code: PECCSIT–501A** |
| **Type Of Course: Theory** | **Course Designation: Elective** |
| **Semester: 5th** | **Contact Hours: 3L/week** |
| **Continuous Assessment: 25 Marks** | **Final Exam: 70 Marks** |

**COURSE OUTCOMES (COs)**

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

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| **PECCSIT–501A.CO1** | Understand the concepts of continuous–time and discrete–time systems and their fundamental properties. | Understand | K2 |
| **PECCSIT–501A.CO2** | Analyze systems in the complex frequency domain using Fourier, Laplace, and z–transforms. | Analyze | K4 |
| **PECCSIT–501A.CO3** | Apply the sampling theorem and study its implications, including signal reconstruction and aliasing effects. | Apply | K3 |
| **PECCSIT–501A.CO4** | Evaluate the behavior of linear time–invariant (LTI) systems and their response to various inputs. | Evaluate | K5 |

**University Syllabus:**

| Unit | Content | Hrs/Unit |
|---|---|---|
| 1 | **Introduction to Signals and Systems**<br>– Overview of signals and systems as encountered in various fields of engineering and science.<br>– Properties of signals: periodicity, absolute integrability, determinism, and stochastic nature.<br>– Important signal types: unit step, unit impulse, sinusoidal, complex exponential, and time–limited signals.<br>– Classification of signals: continuous–time vs. discrete–time, continuous–amplitude vs. discrete–amplitude signals.<br>– System properties: linearity (additivity and homogeneity), shift–invariance, causality, stability, realizability.<br>– Examples of different types of systems. | 3 |
| 2 | **Behavior of Continuous and Discrete–Time LTI Systems**<br>– Impulse response and step response characterization of LTI systems.<br>– Convolution and input–output behavior with periodic convergent inputs.<br>– Cascade interconnections and system stability considerations.<br>– Causality and stability of LTI systems.<br>– Differential and difference equation representation of systems.<br>– State–space representation of systems: state–space analysis, multi–input multi–output (MIMO) representation.<br>– State transition matrix and its significance.<br>– Frequency response of LTI systems and its relation to impulse response. | 8 |
| 3 | **Fourier, Laplace, and z–Transforms**<br>– Fourier series representation of periodic signals and waveform symmetries.<br>– Computation of Fourier coefficients.<br>– Fourier Transform: Convolution/multiplication properties and their impact in the frequency domain. | 10 |

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| | – Magnitude and phase response analysis, Fourier domain duality.<br>– Discrete–Time Fourier Transform (DTFT) and Discrete Fourier Transform (DFT).<br>– Parseval's theorem and its applications.<br>– Review of the Laplace Transform for continuous–time signals and systems.<br>– System functions, poles, and zeros in Laplace domain analysis.<br>– Solving differential equations using Laplace transforms.<br>– Introduction to the z–Transform for discrete–time signals and systems.<br>– System functions, poles, and zeros of discrete–time systems.<br>– Analysis of discrete–time systems using z–transforms. | |
| 4 | **Sampling Theorem and its Implications**<br>– Fundamentals of the sampling theorem and its mathematical derivation.<br>– Frequency domain representation of sampled signals.<br>– Signal reconstruction techniques: ideal interpolator, zero–order hold, and first–order hold.<br>– Aliasing effects and their mitigation strategies.<br>– Relationship between continuous–time and discrete–time systems.<br>– Applications of signal and system theory: modulation techniques in communication, filtering applications, and feedback control systems. | 9 |

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| **Course Title: Mobile Computing** | **Code: PEC–CSIT501B** |
| **Type of Course: Theory** | **Course Designation: Elective** |
| **Semester: 5th** | **Contact Hours: 3L/week** |
| **Continuous Assessment: 25 Marks** | **Final Exam: 70 Marks** |

**COURSE OUTCOMES (COs)**

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

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| **PEC–CSIT501B.CO1** | Analyze the Personal Communication service and GSM architecture | Analyze | K4 |
| **PEC–CSIT501B.CO2** | Develop the concept of GPRS architecture and WLAN standard | Develop | K3 |
| **PEC–CSIT501B.CO3** | Illustrate the WLL structure and the concept of WAP protocol. | Illustrate | K2 |
| **PEC–CSIT501B.CO4** | Discuss the 3G mobile services | Discuss | K1 |
| **PEC–CSIT501B.CO5** | Understand the concept of Global Mobile Satellite Systems and its case studies | Understand | K2 |
| **PEC–CSIT501B.CO6** | Explain the Server–side programming in Java and Pervasive web application architecture | Explain | K2 |

**University Syllabus:**

| Unit | Content | Hrs/Unit |
|---|---|---|
| 1 | Introduction to Personal Communications Services (PCS): PCS Architecture, Mobility management, Networks signalling. Global System for Mobile Communication (GSM) system overview: GSM Architecture, Mobility management, Network signalling. | 5 |
| 2 | General Packet Radio Services (GPRS): GPRS Architecture, GPRS Network Nodes. Mobile Data Communication: WLANs (Wireless LANs) IEEE 802.11 standard, Mobile IP. | 5 |

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| 3 | Wireless Application Protocol (WAP): The Mobile Internet standard, WAP Gateway and Protocols, wireless mark up Languages (WML). Wireless Local Loop(WLL): Introduction to WLL Architecture, wireless Local Loop Technologies. | 7 |
| 4 | Third Generation (3G) Mobile Services: Introduction to International Mobile Telecommunications 2000 (IMT 2000) vision, Wideband Code Division Multiple Access (W-CDMA), and CDMA 2000, Quality of services in 3G | 7 |
| 5 | Global Mobile Satellite Systems; case studies of the IRIDIUM and GLOBALSTAR systems. Wireless Enterprise Networks: Introduction to Virtual Networks, Blue tooth technology, Blue tooth Protocols. | 7 |
| 6 | Server-side programming in Java, Pervasive web application architecture, Device independent example application | 8 |

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| **Course Title: Computer Graphics** | **Code: PEC-IT501D** |
| **Type of Course: Theory** | **Course Designation: Elective** |
| **Semester: 5th** | **Contact Hours: 3L/week** |
| **Continuous Assessment: 25 Marks** | **Final Exam: 70 Marks** |

**COURSE OUTCOMES (COs)**

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

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| **PEC-IT501D.CO1** | Understand the fundamentals of computer graphics, different graphics systems, and graphics hardware. | Understand | K2 |
| **PEC-IT501D.CO2** | Apply various scan conversion techniques for drawing lines, circles, and polygons efficiently. | Apply | K3 |
| **PEC-IT501D.CO3** | Analyze 2D and 3D transformations, coordinate transformations, and viewing pipelines. | Analyze | K4 |
| **PEC-IT501D.CO4** | Implement clipping algorithms for points, lines, polygons, and 3D objects. | Implement | K4 |
| **PEC-IT501D.CO5** | Evaluate different curve representation techniques, hidden surface elimination methods, and shading models in computer graphics. | Evaluate | K5 |

**University Syllabus:**

| Unit | Content | Hrs/Unit |
|---|---|---|

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|---|---|---|
| 1 | **Introduction to Computer Graphics & Graphics Systems**<br>– Overview of computer graphics and its applications.<br>– Representing pictures: preparing, presenting, and interacting with images for visualization and presentations.<br>– Fundamentals of image processing and visualization techniques.<br>– RGB color model: direct coding and lookup tables.<br>– Graphics display technologies: storage tube graphics display, raster scan display, 3D viewing devices.<br>– Graphics hardware: plotters, printers, digitizers, light pens, active and passive graphics devices.<br>– Overview of computer graphics software.<br>Scan Conversion Techniques<br>– Point and line drawing methods.<br>– Line drawing algorithms: Digital Differential Analyzer (DDA), Bresenham's line algorithm.<br>– Circle and ellipse generation algorithms.<br>– Polygon filling techniques: scan–line polygon fill, boundary fill algorithm, flood fill algorithm. | 14 |
| 2 | **2D Transformations & Viewing**<br>– Basic 2D transformations: translation, rotation, scaling.<br>– Matrix representation and homogeneous coordinates.<br>– Coordinate system transformations, reflection, and shear operations.<br>– Transformation of points, lines, parallel and intersecting lines.<br>– Viewing pipeline and window–to–viewport transformations.<br>– Clipping techniques: point clipping, line clipping, polygon clipping.<br>– Line clipping algorithms: Cohen–Sutherland, Cyrus–Beck.<br>– Polygon clipping: Sutherland–Hodgeman algorithm.<br>3D Transformations & Viewing<br>– Basic 3D transformations: translation, rotation, scaling, and other transformations.<br>– Rotation about an arbitrary axis in space, reflection through an arbitrary plane.<br>– General parallel projection transformations.<br>– Clipping in 3D space, viewport clipping, and 3D viewing. | 20 |
| 3 | **Curves and Surfaces Representation**<br>– Introduction to curve representation techniques.<br>– Bezier curves and their properties.<br>– B–spline curves, periodic B–spline curves, and rational B–spline curves.<br>Hidden Surface Elimination<br>– Techniques for removing hidden surfaces and lines.<br>– Depth comparison, Z–buffer algorithm, Back–face detection.<br>– Binary Space Partitioning (BSP) tree method, Painter's algorithm.<br>– Scan–line algorithm, wireframe models, and fractal geometry.<br>Color & Shading Models<br>– Light and color models, interpolative shading models, and texture mapping.<br>– Introduction to ray tracing, human vision and color perception.<br>– Reflection and transmission models. | 6 |

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| **Course Title: Constitution of India** | **Code: MC– CS501** |
| **Type of Course: Theory** | **Course Designation: Compulsory** |
| **Semester: 5th** | **Contact Hours: 3L/week** |
| **Continuous Assessment: 25 Marks** | **Final Exam: 70 Marks** |

**COURSE OUTCOMES (COs)**

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

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| MC–CS501.CO1 | Understand Basic Structure of the Constitution of India | Understand | K2 |
| MC–CS501.CO2 | Apply the understanding in Engineering Profession | Apply | K3 |
| MC–CS501.CO3 | Apply Constitutional Values in Engineering Education | Apply | K3 |
| MC–CS501.CO4 | Apply Constitutional Provisions in Policy matters of CSE | Apply | K3 |

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| MC–CS501.CO5 | Apply Team Spirit and Constitutional Legislative Provisions for Industrial Design | Apply | K3 |
| MC–CS501.CO6 | Analyze Constitutional Valuesof Legislation, Executive & Judiciary in the light of the Professional requirements of Computer Science Engineering | Analyze | K4 |

**University Syllabus :**

| Unit | Content | Hrs/Unit |
|---|---|---|
| 1 | Introduction: Constitution' meaning of the term,, Indian Constitution: Sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy | 3 |
| 2 | Union Government and its Administration : Structure of the Indian Union: Federalism, Centre–State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha | 6 |
| 3 | State Government and its Administration Governor: Role and Position, CM and Council of ministers, State Secretariat: Organisation, Structure and Functions | 6 |
| 4 | Local Administration District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation, Pachayati raj: Introduction, PRI: Zila Pachayat, Elected officials and their roles, CEO Zila Pachayat: Position and role, Block level: Organizational Hierarchy (Different 4.departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy | 8 |
| 5 | Election Commission Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women | 6 |

SEMESTER – V

PRACTICAL

| Course Title: Computer Architecture Lab | Code: PCC–CSIT591 |
|---|---|
| Type of Course: Practical | Course Designation: Compulsory |
| Semester: 5th | Contact Hours: 4P/week |
| Continuous Assessment: 40 Marks | Final Exam: 60 Marks |

**COURSE OUTCOMES (COs)**

On completion of the course students will be able to

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| PCC–CSIT591.CO1 | Discuss the various logic gates using the VHDL programming language. | Discuss | K6 |
| PCC–CSIT591.CO2 | Understanding the arithmetic operations of n– bit numbers using VHDL. | Understand | K2 |
| PCC–CSIT591.CO3 | Analyzing the synthesis of different combinational circuits using VHDL. | Analyze | K4 |
| PCC–CSIT591.CO4 | Illustrate the synthesis of the different sequential circuits using VHDL. | Illustrate | K2 |
| PCC–CSIT591.CO5 | Explain the construction of different memory elements using VHDL. | Explain | K5 |
| PCC–CSIT591.CO6 | Develop different processing elements using VHDL. | Develop | K3 |

**University Syllabus:**

| Unit | Content |
|---|---|
| 1 | HDL introduction |
| 2 | Basic digital logic base programming with HDL |
| 3 | 8–bit Addition, Multiplication, Division 4 5 6 7 8 |
| 4 | 8–bit Register design |
| 5 | Memory unit design and perform memory operations. |
| 6 | 8–bit simple ALU design |
| 7 | 8–bit simple CPU design |
| 8 | Interfacing of CPU and Memory |

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|---|---|
| **Course Title: Software Engineering Lab** | **Code: ESC591** |
| **Type of Course: Practical** | **Course Designation: Compulsory** |
| **Semester: 5th** | **Contact Hours: 4P/week** |
| **Continuous Assessment: 40 Marks** | **Final Exam: 60 Marks** |

**COURSE OUTCOMES (COs)**

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

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| **ESC591.CO1** | Understand the software engineering methodologies involved in the phases for project development. | Understand | K2 |
| **ESC591.CO2** | Extract functional and non–functional requirement for given problem statement. | Extract | K2 |
| **ESC591.CO3** | Choose between different design strategies for real life problem | Choose | K3 |
| **ESC591.CO4** | Develop use case diagrams and activity diagrams, build and test class diagrams, sequence diagrams and add interface to class diagrams. | Develop | K6 |
| **ESC591.CO5** | Design Test Script/Test Plan using Black box and White Box approach. | Design | K6 |
| **ESC591.CO6** | Evaluate Process and Product Metrics using different models. | Evaluate | K5 |

**University Syllabus:**

| Unit | Content |
|---|---|
| 1 | Laboratory Experiments:<br>Problem Analysis and Project Planning –Thorough study of the problem – Identify Project scope, Objectives and Infrastructure. |
| 2 | Software Requirement Analysis – Describe the individual Phases/modules of the project and Identify deliverables. Identify functional and non–functional requirements. |
| 3 | Data Modeling – Use work products – data dictionary |
| 4 | Software Designing – Develop use case diagrams and activity diagrams, build and testclass diagrams, sequence diagrams and add interface to class diagrams. |
| 5 | Prototype model – Develop the prototype of the product<br>The SRS and prototype model should be submitted for end semester examination |

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|---|---|
| **Course Title: Operating System Lab** | **Code: PCC–CS592** |
| **Type of Course: Practical** | **Course Designation: Compulsory** |
| **Semester: 5th** | **Contact Hours: 4P/week** |
| **Continuous Assessment: 40 Marks** | **Final Exam: 60 Marks** |

**COURSE OUTCOMES (COs)**

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

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| **PCC–CS592.CO1** | Understanding of different Unix/Linux commands and shell programming | Understand | K2 |
| **PCC–CS592.CO2** | Demonstrate the creation of processes and POSIX threads. | Demonstrate | K3 |
| **PCC–CS592.CO3** | Develop the problems of process scheduling and process synchronization (Signal and Semaphore) | Develop | K6 |
| **PCC–CS592.CO4** | Determine the deadlock avoidance and detection algorithms. | Determine | K5 |
| **PCC–CS592.CO5** | Analyse different Memory allocation and File accessing techniques | Analyse | K4 |
| **PCC–CS592.CO6** | Illustrate Inter–Process Communication through system calls. | Illustrate | K2 |

**University Syllabus:**

| Unit | Content |
|---|---|
| 1 | **Managing Unix/Linux Operating System [8P]:** Creating a bash shell script, making a script executable, shell syntax (variables, conditions, control structures, functions, commands). Partitions, Swap space, Device files, Raw and Block files, Formatting disks, Making file systems, Superblock, I– nodes, File system checker, Mounting file systems, Logical Volumes, Network File systems, Backup schedules and methods Kernel loading, init and the inittab file, Run–levels, Run level scripts. Password file management, Password security, Shadow file, Groups and the group file, Shells, restricted shells, user–management commands, homes and permissions, default files, profiles, locking accounts, setting passwords, Switching user, Switching group, Removing users &user groups. |
| 2 | **Process [4P]:** starting new process, replacing a process image, duplicating aprocess image, waiting for a process, zombie process. |

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| 3 | **Signal [4P]:** signal handling, sending signals, signal interface, signal sets. |
| 4 | **Semaphore [6P]:** programming with semaphores (use functions semctl, semget,semop, set_semvalue, del_semvalue, semaphore_p, semaphore_v). |
| 5 | **POSIX Threads [6P]:** programming with pthread functions (viz. pthread_create, pthread_join, pthread_exit, pthread_attr_init, pthread_cancel) |
| 6 | **Inter-process communication [6P]:** pipes (use functions pipe, popen, pclose), named pipes(FIFOs, accessing FIFO), message passing & shared memory(IPC version V). |

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|---|---|
| **Course Title: Advanced Programming for Real Life Applications** | **Code: PCC-CSIT592** |
| **Type of Course: Practical** | **Course Designation: Compulsory** |
| **Semester: 5th** | **Contact Hours: 4P/week** |
| **Continuous Assessment: 40 Marks** | **Final Exam: 60 Marks** |

**COURSE OUTCOMES (COs)**

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

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| **PCC-CSIT592.CO1** | Develop proficiency in advanced Python programming concepts such as iterators, generators, concurrency, and memory management. | Develop | K3 |
| **PCC-CSIT592.CO2** | Implement object-oriented programming principles including encapsulation, inheritance, polymorphism, and abstraction through practical assignments. | Implement | K4 |
| **PCC-CSIT592.CO3** | Apply software design patterns to solve real-world problems and enhance software modularity and maintainability. | Apply | K4 |
| **PCC-CSIT592.CO4** | Design and build real-world applications incorporating advanced programming techniques, database interactions, and API integrations. | Design | K5 |
| **PCC-CSIT592.CO5** | Evaluate and optimize program performance using debugging, profiling, and testing methodologies. | Evaluate | K5 |

**University Syllabus:**

| Unit | Content |
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| 1 | **Advanced Python Programming Practicals**<br>– Implement iterators and generators to handle large data efficiently.<br>– Develop programs using decorators and metaclasses for flexible code reuse.<br>– Implement multi–threading, multiprocessing, and asynchronous programming for performance optimization.<br>– Manage memory effectively using reference counting and garbage collection techniques. |
| 2 | **Object–Oriented Programming (OOP) in Python**<br>– Develop Python programs demonstrating encapsulation, inheritance, polymorphism, and abstraction.<br>– Implement operator overloading and magic methods.<br>– Create a modular Python application using SOLID principles and interface–based design. |
| 3 | **Design Patterns and Software Architecture**<br>– Implement Singleton, Factory, and Builder patterns for object creation.<br>– Develop applications using Adapter, Decorator, and Proxy structural patterns.<br>– Apply Strategy and Observer patterns to enhance code maintainability and reusability. |
| 4 | **Application Development with Python**<br>– Develop a Flask/FastAPI–based web application with user authentication and database integration.<br>– Build a data processing pipeline using Pandas and NumPy.<br>– Implement RESTful API integration with external services.<br>– Design a simple GUI–based application using Tkinter or PyQt. |
| 5 | **Performance Optimization and Testing**<br>– Use profiling tools like cProfile to analyze code execution time.<br>– Implement logging and debugging techniques for large–scale applications.<br>– Develop unit tests and integration tests using unittest and pytest.<br>– Apply Test–Driven Development (TDD) methodology in a software project. |
| 6 | **Real–Life Project Implementation**<br>– Develop a complete real–life application using advanced Python techniques, incorporating OOP, design patterns, API calls, and database interaction.<br>– Optimize performance and ensure maintainability by applying best practices in software development.<br>– Document and present the developed project, demonstrating problem–solving skills and implementation strategies. |

SEMESTER – VI

THEORY

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|---|---|
| Course Title: Database Management Systems | Code: PCC– CS601 |
| Type of Course: Theory | Course Designation: Compulsory |
| Semester: 6th | Contact Hours: 3L/week |
| Continuous Assessment: 25 Marks | Final Exam: 70 Marks |

COURSE OUTCOMES (COs)

On completion of the course students will be able to

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| PCC– CS601.CO1 | Describe the basic concept of database and different database models along with database languages like DDL, DML etc, Data Abstraction, and Data Independence. | Describe | K1 |
| PCC– CS601.CO2 | Identify different approaches for solving queries such as Relational algebra, Tuple and domain relational calculus, considering the query optimization strategies, and different normal forms for relational database normalization. | Identify | K3 |
| PCC– CS601.CO3 | Evaluate the applications of different storage strategies such as Indices, B–trees, hashing | Evaluate | K5 |
| PCC– CS601.CO4 | Understand the transaction processing and concurrency control strategies including ACID property, serializability of scheduling, locking and timestamp based schedulers, Database recovery. | Understand | K2 |
| PCC– CS601.CO5 | Analyze the database security approaches including authentication, authorization and access control, DAC, MAC and RBAC models, intrusion detection, SQL injection etc. | Analyze | K4 |
| PCC– CS601.CO6 | Explain the advanced concepts related to DBMS such as object oriented and object relational databases, logical databases, web databases, distributed databases, data warehousing and data mining. | Explain | K2 |

University Syllabus:

| Unit | Content | Hrs/Unit |
|---|---|---|
| 1 | Database system architecture: Data Abstraction, Data Independence,Data Definition Language(DDL),Data Manipulation Language(DML). Data models: Entity–relationship model, network model, relational and object oriented data models, integrity constraints, data manipulation operations. | 9 |
| 2 | Relational query languages: Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS – MYSQL, ORACLE, DB2, SQLserver. Relational database design: Domain and data dependency, Armstrong's axioms, Normal forms, Dependency preservation, Losslessdesign. Query processing and optimization: Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms. | 13 |
| 3 | Storage strategies: Indices, B–trees, hashing. | 3 |
| 4 | Transaction processing: Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multiversion and optimistic Concurrency Control schemes, Database recovery. | 5 |

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|---|---|---|
| 5 | Database Security: Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection. | 3 |
| 6 | Advanced topics: Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining. | 3 |

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|---|---|
| **Course Title: Artificial Intelligence & Machine Learning** | **Code: PCC–CSIT601** |
| **Type of Course: Theory** | **Course Designation: Compulsory** |
| **Semester: 6th** | **Contact Hours: 3L/week** |
| **Continuous Assessment: 25 Marks** | **Final Exam: 70 Marks** |

**COURSE OUTCOMES (COs)**

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

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| **PEC–CSIT601.CO1** | Explain the basic concepts of Regression/ Classification. Extend the concepts of statistical learning theory of various Regression/ Classification methods. | Explain | K2 |
| **PEC– CSIT601.CO2** | Analyze the linear discriminant, logistic regression, non–linear SVM, Kernel methods. | Analyze | K4 |
| **PEC– CSIT601.CO3** | Analyze the varoius concepts of unsupervised learning, Generative Models (mixture models and latent factor models), Dimension reduction, Kernel PCA, Matrix factorization. | Analyze | K4 |
| **PEC– CSIT601.CO4** | Explain Sparse Modeling and Estimation, Modeling Sequence/Time–Series Data, Deep Learning and Feature Representation Learning | Explain | K2 |
| **PEC– CSIT601.CO5** | Evaluate Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, Random Forests) | Evaluate | K5 |
| **PEC– CSIT601.CO6** | Explain the concepts of Scalable Machine Learning (Online and Distributed Learning), Inference in Graphical Models, Introduction to Bayesian Learning and Inference, the recent trends in various learning techniques of machine learning and classification methods. | Explain | K2 |

**University Syllabus:**

| Unit | Content | Hrs/unit |
|---|---|---|

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|---|---|---|
| 1 | **Introduction [2]**<br>Overview of Artificial intelligence– Problems of AI, AI technique, Tic – Tac – Toe problem.<br>**Intelligent Agents [2]**<br>Agents & environment, nature of environment, structure of agents, goal based agents, utility based agents, learning agents.<br>**Problem Solving [2]**<br>Problems, Problem Space & search: Defining the problem as state space search, production system, problem characteristics, issues in the design of search programs. | 4 |
| 2 | **Knowledge & reasoning [3]**<br>Knowledge representation issues, representation & mapping, approaches to knowledge representation, issues in knowledge representation. | 3 |
| 3 | **Using predicate logic [2]**<br>Representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction.<br>**Probabilistic reasoning [4]**<br>Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster–Shafer theory, Fuzzy sets & fuzzy logics. | 6 |
| 4 | **Supervised Learning (Regression/Classification)**<br>Basic methods: Distance–based methods, Nearest–Neighbours, Decision Trees, Naive Bayes Linear models: Linear Regression, Logistic Regression, Generalized Linear Models Support Vector Machines, Nonlinearity and Kernel Methods Beyond Binary Classification: Multi–class/Structured Outputs, Ranking | 8 |
| 5 | **Unsupervised Learning**<br>Clustering: K–means/Kernel K–means Dimensionality Reduction: PCA and kernel PCA Matrix Factorization and Matrix Completion<br>Generative Models (mixture models and latent factor models) | 5 |
| 6 | Evaluating Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, Random Forests) | 5 |
| 7 | Sparse Modeling and Estimation, Modeling Sequence/Time–Series Data, Deep Learning and Feature Representation Learning | 7 |
| 8 | Scalable Machine Learning (Online and Distributed Learning) A selection from some other advanced topics, e.g., Semi–supervised Learning, Active Learning, Reinforcement Learning, Inference in Graphical Models, Introduction to Bayesian Learning and Inference | 7 |

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|---|---|
| **Course Title: Full stack for Web Technology** | **Code: PCC–CSIT602** |
| **Type of Course: Theory** | **Course Designation: Compulsory** |
| **Semester: 6th** | **Contact Hours: 3L/week** |
| **Continuous Assessment: 25 Marks** | **Final Exam: 70 Marks** |

**COURSE OUTCOMES (COs)**

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

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| PCC–CSIT602.CO1 | Understand the architecture and components of full–stack development using the MERN (MongoDB, Express.js, React.js, Node.js) stack. | Understand | K2 |
| PCC–CSIT602.CO2 | Develop RESTful APIs using Node.js and Express.js for handling backend logic and database operations. | Develop | K3 |
| PCC–CSIT602.CO3 | Implement database operations using MongoDB, including CRUD operations, schema design, and indexing. | Implement | K4 |
| PCC–CSIT602.CO4 | Build interactive and dynamic frontend applications using React.js, including state management with Redux. | Build | K4 |

| | | | |
|---|---|---|---|
| PCC–CSIT602.CO5 | Integrate frontend and backend systems using API calls and authentication mechanisms (JWT, OAuth). | Integrate | K5 |
| PCC–CSIT602.CO6 | Deploy and optimize MERN stack applications using cloud services, containerization, and CI/CD pipelines. | Deploy | K6 |

**University Syllabus:**

| Unit | Content | Hrs/unit |
|---|---|---|
| 1 | **Introduction to Full Stack Development & MERN Stack**<br>– Overview of full–stack development and the role of frontend, backend, and database.<br>– Introduction to MERN stack and its advantages over other stacks.<br>– Overview of JavaScript ES6+ features essential for MERN development.<br>– Introduction to Node.js and the role of a backend server.<br>– Understanding package managers (npm, yarn) and version control (Git, GitHub). | 6 |
| 2 | **Backend Development with Node.js & Express.js**<br>– Setting up a Node.js environment and understanding its asynchronous architecture.<br>– Creating a RESTful API using Express.js, middleware, and routing.<br>– Connecting to MongoDB using Mongoose and performing CRUD operations.<br>– Implementing authentication and authorization using JWT and bcrypt.<br>– Error handling and logging in Express.js applications. | 9 |
| 3 | **Frontend Development with React.js**<br>– Introduction to React.js: Components, JSX, and Virtual DOM.<br>– React Hooks and functional components (useState, useEffect, useContext).<br>– State management using Redux and Context API.<br>– Handling forms and user inputs with validation.<br>– API calls from React to the backend using Axios and Fetch API. | 9 |
| 4 | **Database Management with MongoDB**<br>– Overview of NoSQL databases and MongoDB architecture.<br>– Creating and managing databases, collections, and documents.<br>– Schema design, data modeling, and relationships in MongoDB.<br>– Indexing and aggregation framework for efficient data retrieval.<br>– Implementing role–based access control in database management. | 6 |
| 5 | **Integration & Deployment**<br>– Connecting React frontend with Node.js backend via REST APIs.<br>– Implementing authentication with OAuth and third–party logins (Google, Facebook).<br>– Deployment strategies using cloud platforms (Heroku, Vercel, AWS).<br>– Containerizing MERN applications with Docker.<br>– Setting up CI/CD pipelines for automated testing and deployment. | 9 |
| 6 | **Performance Optimization & Security**<br>– Optimizing React applications for performance and scalability.<br>– Security best practices in MERN stack applications (CSRF, CORS, HTTPS, rate limiting).<br>– Load balancing and caching strategies using Redis.<br>– Monitoring applications with logging tools and performance metrics.<br>– Real–world case studies and best practices for full–stack applications. | 6 |

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|---|---|
| Course Title: Advanced Algorithms | Code: PEC–IT601A |
| Type of Course: Theory | Course Designation: Elective |
| Semester: 6th | Contact Hours: 3L/week |
| Continuous Assessment: 25 Marks | Final Exam: 70 Marks |

**COURSE OUTCOMES (COs)**

On completion of the course students will be able to

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| PEC–IT601A.CO1 | Apply the concepts of linear programming, analyze the feasibility region, and solve optimization problems using the Simplex algorithm. | Apply | K3 |
| PEC–IT601A.CO2 | Demonstrate an understanding of NP–completeness, prove NP–hardness, and analyze computational complexity in decision problems. | Demonstrate | K2 |
| PEC–IT601A.CO3 | Explore and implement advanced algorithms, including Approximation Algorithms, Randomized Algorithms, and Interior Point Methods for solving complex computational problems. | Explore | K4 |
| PEC–IT601A.CO4 | Investigate recent trends in problem–solving paradigms, incorporating advanced searching and sorting techniques using modern data structures. | Investigate | K5 |

**University Syllabus :**

| Unit | Content | Hrs/Unit |
|---|---|---|
| 1 | **Sorting:** Review of various sorting algorithms, topological sorting<br>**Graph:** Definitions and Elementary Algorithms: Shortest path by BFS, shortest path in edge–weighted case (Dijkasra's), depth–first search and computation of strongly connected components, emphasis on correctness proof of the algorithm and time/space analysis, example of amortized analysis. | 6 |
| 2 | **Matroids:** Introduction to greedy paradigm, algorithm to compute a maximum weight maximal independent set. Application to MST.<br>**Graph Matching:** Algorithm to compute maximum matching. Characterization of maximum matching by augmenting paths, Edmond's Blossom algorithm to compute augmenting path. | 8 |
| 3 | **Flow–Networks:** Maxflow–mincut theorem, Ford–Fulkerson Method to compute maximum flow, Edmond–Karp maximum–flow algorithm.<br>**Matrix Computations:** Strassen's algorithm and introduction to divide and conquer paradigm, inverse of a triangular matrix, relation between the time complexities of basic matrix operations, LUP–decomposition. | 9 |
| 4 | **Shortest Path in Graphs:** Floyd–Warshall algorithm and introduction to dynamic programming paradigm. More examples of dynamic programming.<br>**Modulo Representation of integers/polynomials:** Chinese Remainder Theorem, Conversion between base–representation and modulo–representation. Extension to polynomials. Application: Interpolation problem. **Discrete Fourier Transform (DFT):** In complex field, DFT in modulo ring. Fast Fourier Transform algorithm. Schonhage–Strassen Integer Multiplication algorithm | 10 |
| 5 | **Linear Programming:** Geometry of the feasibility region and Simplex algorithm<br>**NP–completeness:** Examples, proof of NP–hardness and NP–completeness.<br>**One or more of the following topics based on time and interest**<br>Approximation algorithms, Randomized Algorithms, Interior Point Method, Advanced Number Theoretic Algorithm | 10 |
| 6 | Recent Trands in problem solving paradigms using recent searching and sorting techniques by applying recently proposed data structures. | 5 |

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|---|---|
| **Course Title: Image Processing** | **Code: PEC–IT601D** |
| **Type of Course: Theory** | **Course Designation: Elective** |
| **Semester: 6th** | **Contact Hours: 3L/week** |
| **Continuous Assessment: 25 Marks** | **Final Exam: 70 Marks** |

**COURSE OUTCOMES (COs)**

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

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| PEC–IT601D.CO1 | Understand the fundamental concepts of a digital image processing (DIP) system. | Understand | K2 |
| PEC–IT601D.CO2 | Remember different techniques employed for the enhancement of images. | Remember | K1 |
| PEC–IT601D.CO3 | Apply the Frequency domain Techniques to real life image Processing. | Apply | K3 |
| PEC–IT601D.CO4 | Analyse image segmentation and representation techniques. | Analyse | K4 |
| PEC–IT601D.CO5 | Analyse image restoration procedures | Analyse | K4 |
| PEC–IT601D.CO6 | Understand the rapid advances of (DIP) in Machine vision | Understand | K2 |

**University Syllabus:**

| Unit | Content | Hrs/Unit |
|---|---|---|
| 1 | Introduction [3L] Background, Digital Image Representation, Fundamental steps in Image Processing, Elements of Digital Image Processing – Image Acquisition, Storage, Processing, Communication, Display | 9 |
| 2 | Digital Image Formation [4L] A Simple Image Model, Geometric Model– Basic Transformation (Translation, Scaling, Rotation), Perspective Projection, Sampling & Quantization – Uniform & Non uniform. | 4 |
| 3 | Mathematical Preliminaries[9L] Neighbour of pixels, Connectivity, Relations, Equivalence & Transitive Closure; Distance Measures, Arithmetic/Logic Operations, Fourier Transformation, Properties of The Two Dimensional Fourier Transform, Discrete Fourier Transform, Discrete Cosine & SineTransform | 9 |
| 4 | Image Enhancement [8L] Spatial Domain Method, Frequency Domain Method, Contrast Enhancement – Linear & Nonlinear Stretching, Histogram Processing; Smoothing – Image Averaging, Mean Filter, Low–pass Filtering; Image Sharpening. Highpass Filtering, High– boost Filtering, Derivative Filtering, Homomorphic Filtering; Enhancement in the frequency domain – Low pass filtering, High pass filtering. | 8 |
| 5 | Image Restoration [7L] Degradation Model, Discrete Formulation, Algebraic Approach to Restoration – Unconstrained & Constrained; Constrained Least Square Restoration, Restoration by Homomorphic Filtering, Geometric Transformation – Spatial Transformation, Gray Level Interpolation. | 7 |
| 6 | Image Segmentation [7L] Point Detection, Line Detection, Edge detection, Combined detection, Edge Linking & Boundary Detection – Local Processing, Global Processing via The Hough Transform; Thresholding – Foundation, Simple Global Thresholding, Optimal Thresholding; Region Oriented Segmentation – Basic Formulation, Region Growing by Pixel Aggregation, Region Splitting & Merging. | 7 |

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| **Type of Course: Theory** | **Course Designation: Elective** |
| **Semester: 6th** | **Contact Hours: 3L/week** |
| **Continuous Assessment: 25 Marks** | **Final Exam: 70 Marks** |

**COURSE OUTCOMES (COs)**

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

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| **PEC–CSIT601A.CO1** | Understand the fundamentals of cyber security, key challenges, cyber threats, cyber warfare, and the organizational implications of cyber security. | Understand | K2 |
| **PEC–CSIT601A.CO2** | Identify different types of hackers, cyber–attacks, malware threats, and techniques used in cyber crimes, including sniffing, privilege escalation, and backdoors. | Identify | K3 |
| **PEC–CSIT601A.CO3** | Analyze ethical hacking concepts, social engineering techniques, enterprise security architecture, and vulnerability assessment methodologies. | Analyze | K4 |
| **PEC– CSIT601A.CO4** | Apply cyber forensics investigation techniques, evidence collection procedures, auditing frameworks, and ISO 27001:2013 compliance. | Apply | K4 |
| **PEC–CSIT601A.CO5** | Evaluate cyber laws, intellectual property rights in cyberspace, and legal frameworks governing e–commerce and e–governance. | Evaluate | K5 |

**University Syllabus:**

| Unit | Content | Hrs/Unit |
|---|---|---|
| 1 | **Introduction to Cyber Security**<br>– Importance and challenges in cyber security.<br>– Understanding cyberspace and its vulnerabilities.<br>– Cyber threats and cyber warfare.<br>– CIA (Confidentiality, Integrity, Availability) Triad.<br>– Cyber terrorism and security of critical infrastructure.<br>– Organizational implications of cyber security. | 6 |
| 2 | **Hackers and Cyber Crimes**<br>– Types of hackers: White hat, Black hat, Grey hat, Script kiddies.<br>– Difference between hackers and crackers.<br>– Cyber–attacks and vulnerabilities in systems.<br>– Malware threats: Worms, Trojans, Viruses, Backdoors.<br>– Sniffing techniques and intrusion methods.<br>– Gaining access, escalating privileges, executing applications, hiding files, and covering tracks. | 7 |
| 3 | **Ethical Hacking and Social Engineering**<br>– Concepts and scope of ethical hacking.<br>– Threats and attack vectors.<br>– Information assurance and threat modeling.<br>– Enterprise information security architecture.<br>– Vulnerability assessment and penetration testing.<br>– Types of social engineering attacks and insider threats.<br>– Defense strategies against social engineering. | 8 |
| 4 | **Cyber Forensics and Auditing**<br>– Introduction to cyber forensics and its importance.<br>– Understanding computer equipment and storage media.<br>– Role of a forensics investigator and forensic investigation process.<br>– Collecting network–based evidence and report writing. | 10 |

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|---|---|---|
| | – Auditing methodologies and frameworks.<br>– Planning an audit against a set of audit criteria.<br>– Information Security Management System (ISMS) and ISO 27001:2013 compliance. | |
| 5 | **Cyber Ethics and Laws**<br>– Introduction to cyber laws and their impact on business.<br>– Legal frameworks for e–commerce and e–governance.<br>– Certifying authority and controllers in cybersecurity.<br>– Offenses under the IT Act 2000 and associated penalties.<br>– Intellectual Property Rights (IPR) in cyberspace.<br>– Security at the network layer – IPSec. | 5 |

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|---|---|
| **Course Title: Pattern Recognition** | **Code: PEC–IT602D** |
| **Type of Course: Theory** | **Course Designation: Elective** |
| **Semester: 6th** | **Contact Hours: 3L/week** |
| **Continuous Assessment: 25 Marks** | **Final Exam: 70 Marks** |

**COURSE OUTCOMES (COs)**

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

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| **PEC–IT602D.CO1** | Describe the basic concepts of pattern recognition (measuring objects, features and patterns, representation, per–processing, distance and similarity measures) and analyses bayes classifiers in terms of error probabilities, discriminant functions, decision surfaces, normal density and discriminant functions, discrete features | Describe | K1 |
| **PEC–IT602D.CO2** | Explainthe parameter estimation methods using the maximum–likelihood estimation, gaussian mixture models, expectation–maximization method and bayesian estimation and the non–parametric techniques such as k–Nearest neighbours, parzen window for density estimation. | Explain | K2 |
| **PEC–IT602D.CO3** | Analyze the linear discriminant function based classifier design such as perceptron and support vector machines | Analyze | K4 |
| **PEC–IT602D.CO4** | Illustrate hidden markov models for sequential pattern recognition | Illustrate | K2 |
| **PEC–IT602D.CO5** | Exemplify the Non–metric methods for pattern classification and formulate the dimension reduction methods such as principal component analysis, fischer's discriminant Analysis | Exemplify | K6 |
| **PEC–IT602D.CO6** | Explain unsupervised learning and clustering algorithms, and analyses their strengths and weakness | Explain | K2 |

**University Syllabus:**

| Unit | Content | Hrs/Unit |
|---|---|---|
| 1 | Basics of pattern recognition | 2 |
| 2 | Bayesian decision theory 8L Classifiers, Discriminant functions, Decision surfaces Normal density and discriminant functions Discrete features | 8 |
| 3 | Parameter estimation methods 6L Maximum−Likelihood estimation Gaussian mixture models Expectation−maximization method Bayesian estimation | 6 |
| 4 | Hidden Markov models for sequential pattern classification 8L Discrete hidden Markov models Continuous density hidden Markov models | 8 |
| 5 | Dimension reduction methods 5.1. Fisher discriminant analysis 5.2Principal component analysis. Parzen−window method K−Nearest Neighbour method | 3 |
| 6 | Non−parametric techniques for density estimation | 2 |
| 7 | Linear discriminant function based classifier 5L Perceptron Support vector machines | 5 |
| 8 | Non−metric methods for pattern classification 4L Non−numeric data or nominal data Decision trees | 4 |
| 9 | Unsupervised learning and clustering 2L Criterion functions for clustering Algorithms for clustering: K−means, Hierarchical and other methods | 2 |

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|---|---|
| **Course Title: Numerical Methods** | **Code: OEC−IT601A** |
| **Type of Course: Theory** | **Course Designation: Elective** |
| **Semester: 6th** | **Contact Hours: 3L/week** |
| **Continuous Assessment: 25 Marks** | **Final Exam: 70 Marks** |

**COURSE OUTCOMES (COs)**

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

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| OEC−IT601A.CO1 | Understand the basic elements of numerical methods and error analysis. | Understand | K2 |
| OEC−IT601A.CO2 | Understand the theoretical aspects of the use of numerical methods. | Understand | K2 |
| OEC−IT601A.CO3 | Apply the concepts of numerical methods to design algorithms for automated processing. | Apply | K3 |
| OEC−IT601A.CO4 | Evaluate the limitations, advantages, and disadvantages of different numerical methods. | Evaluate | K5 |
| OEC−IT601A.CO5 | Evaluate and Apply appropriate numerical method approach for a given problem. | Evaluate | K5 |
| OEC−IT601A.CO6 | Implement numerical methods for solving various engineering problems. | Implement | K3 |

**University Syllabus:**

| Unit | Content | Hrs/Unit |
|---|---|---|

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|---|---|---|
| 1 | Approximation in numerical computation: Truncation and rounding errors, Fixed and floatingpoint arithmetic, Propagation of errors | 2 |
| 2 | Interpolation: Newton forward/backward interpolation, Lagrange's and Newton's divided difference Interpolation. | 8 |
| 3 | Numerical integration: Trapezoidal rule, Simpson's 1/3 rule, Expression for corresponding error terms. | 3 |
| 4 | Numerical solution of a system of linear equations: Gauss elimination method, Matrix inversion, LU Factorization method, Gauss–Seidel iterative method. | 8 |
| 5 | Numerical solution of Algebraic equation: Bisection method, Regula–Falsi method, Newton– Raphson method. | 3 |
| 6 | Numerical solution of ordinary differential equation: Euler's method, Runge–Kutta methods, PredictorCorrector methods and Finite Difference method. | 2 |

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| **Course Title: Human Resource Development and Organizational Behavior** | **Code: OEC–IT601B** |
| **Type of Course: Theory** | **Course Designation: Elective** |
| **Semester: 6th** | **Contact Hours: 3L/week** |
| **Continuous Assessment: 25 Marks** | **Final Exam: 70 Marks** |

**COURSE OUTCOMES (COs)**

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

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| OEC–IT601B.CO1 | Understand the fundamental concepts of Organizational Behavior (OB), including its importance, challenges, and historical background. | Understand | K2 |
| OEC–IT601B.CO2 | Analyze personality traits, attitudes, job satisfaction, and their impact on workplace behavior. | Analyze | K4 |
| OEC–IT601B.CO3 | Evaluate the role of perception in decision–making and compare various motivation theories such as Maslow's Hierarchy of Needs, McGregor's Theory X & Y, and Herzberg's Motivation–Hygiene Theory. | Evaluate | K5 |
| OEC–IT601B.CO4 | Examine group behavior, communication processes, and leadership styles, along with their impact on organizational effectiveness. | Examine | K4 |
| OEC–IT601B.CO5 | Apply conflict management strategies, organizational politics, and negotiation techniques to resolve workplace conflicts effectively. | Apply | K3 |
| OEC–IT601B.CO6 | Assess the impact of organizational design, climate, and culture on employee behavior and overall business performance. | Assess | K5 |

**University Syllabus:**

| Unit | Content | Hrs/Unit |
|---|---|---|
| 1 | Organizational Behaviour: Definition, Importance, Historical Background, Fundamental Concepts of OB, Challenges and Opportunities for OB. [2] Personality and Attitudes: Meaning of personality, Personality Determinants and Traits, Development of Personality, Types of Attitudes, Job Satisfaction. | 4 |
| 2 | Perception: Definition, Nature and Importance, Factors influencing Perception, Perceptual Selectivity, Link between Perception and Decision Making. [2]<br>4. Motivation: Definition, Theories of Motivation – Maslow's Hierarchy of Needs Theory, McGregor's Theory X & Y, Herzberg's Motivation–Hygiene Theory, Alderfer's ERG Theory, McClelland's Theory of Needs, Vroom's Expectancy Theory. | 8 |
| 3 | Group Behaviour: Characteristics of Group, Types of Groups, Stages of Group Development, Group Decision Making. [2]<br>Communication: Communication Process, Direction of Communication, Barriers to Effective Communication. [2]<br>Leadership: Definition, Importance, Theories of Leadership styles | 4 |
| 4 | Organizational Politics: Definition, Factors contributing to Political Behaviour. [2]<br>Conflict Management: Traditional vis–a–vis Modern View of Conflict, Functional and Dysfunctional Conflict, Conflict Process, Negotiation – Bargaining Strategies, Negotiation Process. [2] Organizational Design: Various Organizational Structures and their Effects on Human Behaviour, Concepts of Organizational Climate and Organizational Culture. | 8 |

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|---|---|
| **Course Title: Research Methodology** | **Code: PROJ– CS601** |
| **Type of Course: Theory** | **Course Designation: Compulsory** |
| **Semester: 6th** | **Contact Hours: 3L/week** |
| **Continuous Assessment: 25 Marks** | **Final Exam: 70 Marks** |

**COURSE OUTCOMES (COs)**

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

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| PROJ– CS601.CO1 | Define and understand the motivation and objectives of research work | Define | K1 |
| PROJ– CS601.CO2 | Explain how to define and formulate a research problem | Explain | K2 |
| PROJ– CS601.CO3 | Identify the importance of literature review in a research work | Identify | K3 |
| PROJ– CS601.CO4 | Examine the appropriate statistical methods required for a particular research design and develop the appropriate research hypothesis for a research project | Examine | K4 |
| PROJ– CS601.CO5 | Explain the ethical issues involved while undertaking research | Explain | K2 |

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| PROJ– CS601.CO6 | Develop the skill set to correctly present a research work by following the protocols of writing a standard research report. | Develop | K6 |

**University Syllabus:**

| Unit | Content | Hrs/Unit |
|---|---|---|
| 1 | RESEARCH FORMULATION AND DESIGN Motivation and objectives – Research methods vs. Methodology. Types of research – Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical, concept of applied and basic research process, criteria of good research. Defining and formulating the research problem, selecting the problem, necessity of defining the problem, importance of literature review in defining a problem, literature review–primary and secondary sources, reviews, monograph, patents, research databases, web as a source, searching the web, critical literature review, identifying gap areas from literature and research database, development of working hypothesis. | 9 |
| 2 | DATA COLLECTION AND ANALYSIS Accepts of method validation, observation and collection of data, methods of data collection, sampling methods, data processing and analysis strategies and tools,data analysis with statically package (Sigma STAT,SPSS for student t–test, ANOVA, etc.), hypothesis testing | 9 |
| 3 | RESEARCH ETHICS, IPR AND SCHOLARY PUBLISHING Ethics–ethical issues, ethical committees (human & animal); IPR– intellectual property rights and patent law, commercialization, copy right, royalty, trade related aspects of intellectual property rights (TRIPS); scholarly publishing– IMRAD concept and design of research paper, citation and acknowledgement, plagiarism, reproducibility and accountability | 9 |
| 4 | INTERPRETATION AND REPORT WRITING Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Project Report, Layout of the Project/Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Project/Research Report, Precautions for Writing Research Reports, Conclusions. | 9 |

SEMESTER – VI

LAB

| Course Title: Database Management System Lab | Code: PCC–CS691 |
|---|---|
| Type of Course: Practical | Course Designation: Compulsory |
| Semester: 6th | Contact Hours: 4P/week |
| Continuous Assessment: 40 Marks | Final Exam: 60 Marks |

**COURSE OUTCOMES (COs)**

On completion of the course students will be able to

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| PCC–CS691.CO1 | Analyze and transform an Entity Relationship Model into a relational database schema and to use a data definition language to implement the schema using a DBMS | Analyze | K4 |
| PCC–CS691.CO2 | Declare and enforce integrity constraints on a database using a DBMS | Declare | K1 |
| PCC–CS691.CO3 | Populate and query a database using SQL DML/DDL commands. | Populate | K3 |
| PCC–CS691.CO4 | Retrieve of data from a database. | Retrieve | K3 |
| PCC–CS691.CO5 | Describe and implement relational algebra expression using aggregate functions, joins and sub–queries. | Describe | K1 |
| PCC–CS691.CO6 | Compile programs in PL/SQL including stored procedures, stored functions, cursors, packages. | Compile | K6 |

**University Syllabus:**

| Unit | Content |
|---|---|
| 1 | Structured Query Language<br>• Creating Database Creating a Database<br>• Creating a Table<br>• Specifying Relational Data Types<br>• Specifying Constraints<br>• Creating Indexes |
| 2 | Table and Record Handling INSERT statement, Using SELECT and INSERT together, DELETE, UPDATE, TRUNCATE statements, DROP, ALTER statements |

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| 3 | Retrieving Data from a Database<br>1. The SELECT statement<br>2. Using the WHERE clause<br>3. Using Logical Operators in the WHERE clause<br>4. Using IN, BETWEEN, LIKE , ORDER BY, GROUP BY and HAVING Clause<br>5. Using Aggregate Functions<br>6. Combining Tables Using JOINS<br>7. Subqueries |
| 4 | Database Management<br>Creating Views, Creating Column Aliases, Creating Database Users, Using GRANT and REVOKE |
| 5 | Cursors in Oracle PL / SQL<br>Writing Oracle PL / SQL Stored Procedures |

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|---|---|
| **Course Title: Full Stack for Web Technology Lab** | **Code: PCC–CSIT692** |
| **Type of Course: Practical** | **Course Designation: Compulsory** |
| **Semester: 6th** | **Contact Hours: 4P/week** |
| **Continuous Assessment: 40 Marks** | **Final Exam: 60 Marks** |

**COURSE OUTCOMES (COs)**

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

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| PCC–CS692.CO1 | Set up a MERN stack development environment and create basic web applications using Node.js, Express.js, React.js, and MongoDB. | Create | K3 |
| PCC–CS692.CO2 | Develop RESTful APIs using Express.js and perform CRUD operations with MongoDB. | Develop | K4 |
| PCC–CS692.CO3 | Build interactive and dynamic user interfaces using React.js, including state management techniques. | Build | K4 |
| PCC–CS692.CO4 | Integrate frontend and backend applications with API calls and authentication mechanisms (JWT, OAuth). | Integrate | K5 |
| PCC–CS692.CO5 | Deploy and optimize MERN applications using cloud platforms, containerization, and CI/CD pipelines. | Deploy | K6 |

**University Syllabus:**

| Unit | Content |
|---|---|
| 1 | **Setting Up the Development Environment**<br>– Installing and configuring Node.js, MongoDB, and React.js.<br>– Setting up a basic Express.js server.<br>– Understanding npm, yarn, and package management.<br>– Version control with Git and GitHub. |
| 2 | **Backend Development with Node.js & Express.js**<br>– Creating a RESTful API using Express.js.<br>– Implementing CRUD operations with MongoDB.<br>– Middleware usage in Express.js (authentication, logging, error handling). |

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| | – Connecting the backend to a MongoDB database using Mongoose |
| 3 | **Frontend Development with React.js**<br>– Creating React components and using JSX.<br>– Managing state with React Hooks (useState, useEffect).<br>– Implementing React Router for navigation.<br>– Fetching data from the backend using Axios or Fetch API. |
| 4 | **Integration of Frontend and Backend**<br>– Connecting React frontend with Node.js backend via API calls.<br>– Implementing JWT-based authentication and user authentication flows.<br>– Handling authentication with OAuth (Google, Facebook login).<br>– Secure API endpoints using middleware in Express.js. |
| 5 | **Deployment and Optimization**<br>– Deploying MERN applications on cloud platforms (Heroku, Vercel, AWS).<br>– Containerizing MERN applications using Docker.<br>– Setting up CI/CD pipelines for automated testing and deployment.<br>– Performance optimization techniques (lazy loading, caching, minification). |
| 6 | **Project Development & Case Study**<br>– Developing a real-world MERN stack project with authentication and database integration.<br>– Implementing best practices for security, scalability, and maintainability.<br>– Documentation, testing, and presenting the developed project. |

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| **Course Title: Artifical Intelligence and Machine Learning Lab** | **Code: PCC-CSIT691** |
| **Type of Course: Practical** | **Course Designation: Compulsory** |
| **Semester: 6th** | **Contact Hours: 4P/week** |
| **Continuous Assessment: 40 Marks** | **Final Exam: 60 Marks** |

**COURSE OUTCOMES (COs)**

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

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| PCC-CS691.CO1 | Implement AI search techniques and problem-solving strategies using state-space representation. | Implement | K3 |
| PCC-CS691.CO2 | Develop knowledge-based reasoning systems using predicate logic and probabilistic models. | Develop | K4 |
| PCC-CS691.CO3 | Apply supervised learning techniques for regression and classification tasks. | Apply | K4 |
| PCC-CS691.CO4 | Explore unsupervised learning techniques like clustering, dimensionality reduction, and generative models. | Explore | K4 |
| PCC-CS691.CO5 | Evaluate machine learning models, ensemble methods, and deep learning techniques for practical applications. | Evaluate | K5 |
| PCC-CS691.CO6 | Implement scalable AI and ML solutions using distributed learning and reinforcement learning techniques. | Implement | K5 |

**University Syllabus:**

| Unit | Content |
|---|---|
| 1 | **Introduction to AI and Intelligent Agents**<br>– Implementing a Tic-Tac-Toe AI using Minimax algorithm.<br>– Developing goal-based and utility-based agent programs.<br>– Simulating an environment for AI agents to learn and interact. |

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| 2 | **Knowledge Representation and Reasoning**<br>– Representing knowledge using logical statements and production rules.<br>– Implementing predicate logic to represent and infer knowledge.<br>– Developing Bayesian networks for probabilistic reasoning in uncertain environments. |
| 3 | **Supervised Learning Techniques**<br>– Implementing distance–based methods (KNN) for classification.<br>– Developing decision trees and Naïve Bayes classifiers.<br>– Implementing linear regression, logistic regression, and support vector machines (SVM).<br>– Exploring kernel–based methods for non–linearity handling. |
| 4 | **Unsupervised Learning Techniques**<br>– Implementing K–Means and Kernel K–Means clustering algorithms.<br>– Performing dimensionality reduction using PCA and Kernel PCA.<br>– Implementing Matrix Factorization techniques for recommendation systems.<br>– Developing generative models for latent factor analysis. |
| 5 | **Evaluating Machine Learning Models and Ensemble Learning**<br>– Implementing model selection strategies and hyperparameter tuning.<br>– Applying ensemble methods like boosting, bagging, and random forests.<br>– Understanding statistical learning theory and bias–variance tradeoff. |
| 6 | **Advanced AI and Scalable ML Techniques**<br>– Implementing sparse modeling and estimation techniques.<br>– Developing time–series forecasting models using deep learning.<br>– Exploring reinforcement learning algorithms for decision–making.<br>– Implementing scalable ML techniques using distributed and online learning.<br>– Introduction to Bayesian learning and probabilistic inference. |

## SEMESTER – VII

## THEORY

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|---|---|
| **Course Title: Mobile Application Development** | **Code: PCC–CSIT701** |
| **Type of Course: Theory** | **Course Designation: Compulsory** |
| **Semester: 7th** | **Contact Hours: 3L/week** |
| **Continuous Assessment: 25 Marks** | **Final Exam: 70 Marks** |

**COURSE OUTCOMES (COs)**

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

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| **PCC– CSIT701.CO1** | Understand the architecture and components of mobile application development using Flutter, PHP, and MySQL. | Understand | K2 |
| **PCC– CSIT701.CO2** | Develop cross–platform mobile applications for iOS and Android using Flutter and Dart. | Develop | K3 |
| **PCC– CSIT701.CO3** | Implement backend services using PHP and integrate MySQL databases for dynamic data handling. | Implement | K4 |
| **PCC– CSIT701.CO4** | Apply state management techniques in Flutter for efficient UI updates and data handling. | Apply | K4 |

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|---|---|---|---|
| PCC– CSIT701.CO5 | Integrate APIs, authentication mechanisms, and third–party services to enhance mobile app functionality. | Integrate | K5 |
| PCC– CSIT701.CO6 | Deploy, test, and optimize mobile applications for performance, scalability, and security. | Deploy | K6 |

**University Syllabus :**

| Unit | Content | Hrs/Unit |
|---|---|---|
| 1 | **Introduction to Mobile Application Development**<br>– Overview of mobile application development for iOS and Android.<br>– Comparison of cross–platform vs. native development.<br>– Introduction to Flutter framework and Dart programming language.<br>– Setting up the development environment: Android Studio, Xcode, Flutter SDK.<br>– Understanding widgets, stateful and stateless widgets, UI structure. | 6 |
| 2 | **Flutter Basics and UI Components**<br>– Layouts and navigation in Flutter: Row, Column, Stack, ListView, GridView.<br>– Handling user inputs: TextField, Buttons, Dropdowns.<br>– State management techniques: Provider, Riverpod, Bloc.<br>– Theme management, animations, and styling in Flutter.<br>– Handling device permissions and accessing hardware features (camera, location). | 9 |
| 3 | **Backend Development with PHP and MySQL**<br>– Introduction to server–side scripting with PHP.<br>– Connecting MySQL database with PHP and performing CRUD operations.<br>– RESTful API creation using PHP for Flutter applications.<br>– JSON data handling and API response parsing in Flutter.<br>– Implementing authentication using JWT and OAuth. | 9 |
| 4 | **Database Management and API Integration**<br>– Structuring relational databases for mobile applications.<br>– Creating APIs for data retrieval and real–time updates.<br>– Securing APIs and database queries to prevent SQL injection.<br>– Handling API requests and responses in Flutter using HTTP and Dio.<br>– Offline data storage techniques: SharedPreferences, SQLite, Hive. | 6 |
| 5 | **Advanced Mobile App Features**<br>– Push notifications using Firebase Cloud Messaging (FCM).<br>– Implementing real–time chat functionality with WebSockets.<br>– Payment gateway integration (Razorpay, Stripe, PayPal).<br>– Background services, job scheduling, and data synchronization.<br>– Debugging, logging, and performance optimization. | 9 |
| 6 | **Deployment and Maintenance**<br>– Preparing applications for production: Code signing, package building.<br>– Publishing apps on Google Play Store and Apple App Store.<br>– CI/CD pipeline setup for automatic builds and deployment.<br>– App security best practices and data encryption techniques.<br>– Post–deployment monitoring, updates, and analytics integration. | 6 |

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|---|---|
| Course Title: Quantum Computing | Code: PEC–IT701B |
| Type of Course: Theory | Course Designation: Elective |
| Semester: 7th | Contact Hours: 3L/week |
| Continuous Assessment: 25 Marks | Final Exam: 70 Marks |

COURSE OUTCOMES (COs)

On completion of the course students will be able to

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| PEC–IT701B.CO1 | Understand the fundamental principles of quantum physics from a computer science perspective. | Understand | K2 |
| PEC–IT701B.CO2 | Analyze how quantum mechanics describes reality and influences computational models. | Analyze | K4 |
| PEC–IT701B.CO3 | Explore the philosophical implications of quantum computing and its impact on future technologies. | Explore | K4 |
| PEC–IT701B.CO4 | Apply quantum principles to computational problems and emerging quantum algorithms. | Apply | K3 |

**University Syllabus :**

| Unit | Content | Hrs/Unit |
|---|---|---|
| 1 | Qubit & Quantum States: The Qubit, Vector Spaces. Linear Combination Of Vectors, Uniqueness of a spanning set, basis & dimensions, inner Products, orthonormality, gram–schmidt orthogonalization, bra–ket formalism, the Cauchyschwarez and triangle Inequalities. | 3 |
| 2 | Matrices & Operators: Observables, The Pauli Operators, Outer Products, The Closure Relation, Representation of operators using matrices, outer products & matrix representation, matrix representation of operators in two dimensional spaces, Pauli Matrix, Hermitian unitary and normal operator, Eigen values & Eigen Vectors, Spectral Decomposition, Trace of an operator, important properties of Trace, Expectation Value of Operator, Projection Operator, Positive Operators, | 10 |
| 3 | Commutator Algebra, Heisenberg uncertainty principle, polar decomposition &singular values, Postulates of Quantum Mechanics. | 5 |
| 4 | Tensor Products: Representing Composite States in Quantum Mechanics, Computing inner products, Tensor products of column vectors, operators and tensor products of Matrices. Density Operator: Density Operator of Pure & Mix state, Key Properties, Characterizing Mixed State, Practical Trace & Reduce Density Operator, Density Operator & Bloch Vector. | 5 |
| 5 | Quantum Measurement Theory: Distinguishing Quantum states & Measures, Projective Measurements, Measurement on Composite systems, Generalized Measurements, Positive Operator– Valued Measures. | 8 |
| 6 | Recent trends in Quantum Computing Research, Quantum Computing Applications of Genetic Programming. | 6 |

| Course Title: Cloud Computing | Code: PEC–IT701C |
|---|---|
| Type of Course: Theory | Course Designation: Elective |
| Semester: 7th | Contact Hours: 3L/week |
| Continuous Assessment: 25 Marks | Final Exam: 70 Marks |

**COURSE OUTCOMES (COs)**

On completion of the course students will be able to

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| PEC–IT701C.CO1 | Understand the fundamentals of cloud computing, cloud models, and service models (IaaS, PaaS, SaaS, IDaaS, CaaS). | Understand | K2 |
| PEC–IT701C.CO2 | Analyze cloud deployment models (Public, Private, Hybrid, and Community) and their advantages. | Analyze | K4 |
| PEC–IT701C.CO3 | Apply virtualization techniques, cloud infrastructure components, and load balancing mechanisms in cloud environments. | Apply | K3 |
| PEC–IT701C.CO4 | Evaluate cloud–based platforms, APIs, and development environments such as Google App Engine and Microsoft Azure. | Evaluate | K5 |
| PEC–IT701C.CO5 | Implement cloud security mechanisms, identity management protocols, and compliance strategies for data protection. | Implement | K4 |
| PEC–IT701C.CO6 | Explore cloud storage solutions, cloud–based email services, and syndication services for modern computing. | Explore | K4 |

**University Syllabus:**

| Unit | Content | Hrs/Unit |
|---|---|---|
| 1 | **Definition of Cloud Computing and its Basics (Lectures ).** Defining a Cloud, Cloud Types – NIST model, Cloud Cube model, Deployment models (Public , Private, Hybrid and Community Clouds), Service Platform as a Service, Software as a Service with examples of services/ service providers, models – Infrastructure as a Service, Cloud Reference model, Characteristics of Cloud Computing – a shift in paradigm Benefits and advantages of Cloud Computing, A brief introduction on Composability, Infrastructure, Platforms, Virtual Appliances, Communication Protocols, Applications, Connecting to the Cloud by Clients, IaaS – Basic concept, Workload, partitioning of virtual private server instances, Pods, aggregations, silos PaaS – Basic concept, tools and development environment with examples SaaS – Basic concept and characteristics, Open SaaS and SOA, examples of SaaS platform Identity as a Service (IDaaS) Compliance as a Service (CaaS) | 3 |
| 2 | **Use of Platforms in Cloud Computing** Concepts of Abstraction and Virtualization Virtualization technologies : Types of virtualization (access, application, CPU, storage), Mobility patterns (P2V, V2V, V2P, P2P, D2C, C2C, C2D, D2D) Load Balancing and Virtualization: Basic Concepts, Network resources for load balancing, Advanced load balancing (including Application Delivery Controller and Application Delivery Network), Mention of The Google Cloud as an example of use of load balancing Hypervisors: Virtual machine technology and types, VMware vSphere Machine Imaging (including mention of Open Virtualization Format – OVF) Porting of applications in the Cloud: The simple Cloud API and AppZero Virtual Application appliance,Concepts of Platform as a Service, Definition of services, Distinction between SaaS and PaaS (knowledge of Salesforce.com and Force.com), Application development Use of PaaS Application frameworks, Discussion of Google Applications Portfolio – Indexed search, Dark Web, Aggregation and disintermediation, Productivity applications and service, Adwords, Google Analytics, Google Translate, a brief discussion on Google Toolkit (including introduction of Google APIs in brief), major features of Google App Engine service., Discussion of Google Applications Portfolio – Indexed | 10 |

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| | search, Dark Web, Aggregation and disintermediation, Productivity applications and service, Adwords, Google Analytics, Google Translate, a brief discussion on Google Toolkit (including introduction of Google APIs in brief), major features of Google App Engine service, Windows Azure platform: Microsoft's approach, architecture, and main elements, overview of Windows Azure AppFabric, Content Delivery Network, SQL Azure, and Windows Live services, | |
| 3 | **Cloud Infrastructure:**<br>Cloud Management:<br>An overview of the features of network management systems and a brief introduction of related products from large cloud vendors, Monitoring of an entire cloud computing deployment stack – an overview with mention of some products, Lifecycle management of cloud services (six stages of lifecycle).<br>Concepts of Cloud Security:<br>Cloud security concerns, Security boundary, Security service boundary Overview of security mapping<br>Security of data: Brokered cloud storage access, Storage location and tenancy, encryption, and auditing and compliance Identity management (awareness of Identity protocol standards) | 5 |
| 4 | **Cloud Infrastructure:**<br>Cloud Management:<br>An overview of the features of network management systems and a brief introduction of related products from large cloud vendors, Monitoring of an entire cloud computing deployment stack – an overview with mention of some products, Lifecycle management of cloud services (six stages of lifecycle).<br>Concepts of Cloud Security:<br>Cloud security concerns, Security boundary, Security service boundary Overview of security mapping Security of data: Brokered cloud storage access, Storage location and tenancy, encryption, and auditing and compliance Identity management (awareness of Identity protocol standards) Application attributes, Cloud service attributes, System abstraction and Cloud Bursting, Applications and Cloud APIs<br>Cloud–based Storage: Cloud storage definition – Manned and Unmanned<br>Webmail Services: Cloud mail services including Google Gmail, Mail2Web, Windows Live Hotmail, Yahoo mail, concepts of Syndication services | 5 |

| Course Title: Data Warehousing & Mining | Code: PEC–CSIT701A |
|---|---|
| Type of Course: Theory | Course Designation: Elective |
| Semester: 7th | Contact Hours: 3L/week |
| Continuous Assessment: 25 Marks | Final Exam: 70 Marks |

**COURSE OUTCOMES (COs)**

On completion of the course students will be able to

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| PEC–CSIT701A.CO1 | Understand the fundamental concepts of data warehousing, data mining, and their applications in industry. | Understand | K2 |
| PEC–CSIT701A.CO2 | Design and implement data warehouse architectures, including ETL processes and OLAP operations. | Design, Implement | K4 |
| PEC–CSIT701A.CO3 | Apply data preprocessing techniques and feature engineering for efficient data mining. | Apply | K3 |
| PEC–CSIT701A.CO4 | Implement industry–standard data mining techniques, including classification, clustering, and association rule mining. | Implement | K4 |
| PEC–CSIT701A.CO5 | Analyze big data using advanced mining techniques, including deep learning, text mining, and graph–based mining. | Analyze | K5 |
| PEC–CSIT701A.CO6 | Evaluate the impact of data governance, security, and ethical considerations in data warehousing and mining. | Evaluate | K5 |

**University Syllabus:**

| Unit | Content | Hrs/Unit |
|---|---|---|
| 1 | **Introduction to Data Warehousing and Data Mining**<br>– Definition, scope, and applications of data warehousing and mining.<br>– Differences between operational databases and data warehouses.<br>– Data warehouse architecture: 2–tier and 3–tier architecture.<br>– Introduction to OLAP, ROLAP, MOLAP, HOLAP.<br>– Industry case studies on data warehousing applications. | 6 |
| 2 | **Data Warehouse Design and ETL Process**<br>– Data modeling for data warehouses: Star, Snowflake, and Fact Constellation schemas.<br>– Data extraction, transformation, and loading (ETL) processes.<br>– Data warehouse implementation strategies and indexing techniques.<br>– Data lake concepts and cloud–based data warehousing (AWS Redshift, Google BigQuery). | 9 |
| 3 | **Data Preprocessing and Feature Engineering**<br>– Data cleaning, integration, transformation, and reduction techniques.<br>– Handling missing values, noise removal, and outlier detection.<br>– Feature selection and dimensionality reduction (PCA, LDA).<br>– Data discretization and normalization techniques. | 6 |

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| 4 | **Data Mining Techniques and Applications**<br>– Classification algorithms: Decision Trees, Naïve Bayes, Random Forest, SVM, Neural Networks.<br>– Clustering algorithms: K–Means, DBSCAN, Hierarchical Clustering.<br>– Association Rule Mining: Apriori and FP–Growth algorithms.<br>– Industry applications: Fraud detection, recommendation systems, and customer segmentation. | 9 |
| 5 | **Big Data Analytics and Advanced Mining**<br>– Introduction to big data frameworks (Hadoop, Spark, NoSQL).<br>– Text mining and Natural Language Processing (NLP).<br>– Graph–based mining techniques (PageRank, community detection).<br>– Deep learning for data mining: CNNs, RNNs, and Autoencoders. | 9 |
| 6 | **Data Governance, Security, and Ethical Considerations**<br>– Privacy–preserving data mining and differential privacy.<br>– Ethical considerations in AI–driven decision–making.<br>– Compliance with data protection laws (GDPR, CCPA).<br>– Industry best practices for data security in warehousing and mining. | 6 |

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| **Course Title: Computer Vision** | **Code: PEC–CSIT701B** |
| **Type of Course: Theory** | **Course Designation: Elective** |
| **Semester: 7th** | **Contact Hours: 3L/week** |
| **Continuous Assessment: 25 Marks** | **Final Exam: 70 Marks** |

**COURSE OUTCOMES (COs)**

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

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| **PEC–CSIT701B.CO1** | Understand the fundamentals of image processing, computer vision techniques, and their real–world applications. | Understand | K2 |
| **PEC–CSIT701B.CO2** | Implement image acquisition, filtering, and feature extraction techniques for vision–based applications. | Implement | K4 |
| **PEC–CSIT701B.CO3** | Apply machine learning and deep learning techniques for object detection, recognition, and segmentation. | Apply | K4 |
| **PEC–CSIT701B.CO4** | Analyze 3D vision concepts, stereo vision, and motion tracking methods for real–time applications. | Analyze | K5 |
| **PEC–CSIT701B.CO5** | Develop industry–grade computer vision solutions for applications in healthcare, autonomous systems, and surveillance. | Develop | K6 |
| **PEC–CSIT701B.CO6** | Evaluate the ethical concerns, limitations, and advancements in modern computer vision technologies. | Evaluate | K5 |

**University Syllabus:**

| Unit | Content | Hrs/Unit |
|---|---|---|
| 1 | **Introduction to Computer Vision and Image Processing**<br>– Fundamentals of computer vision and applications in various industries.<br>– Image formation, color models, and types of images.<br>– Image acquisition techniques using cameras and sensors.<br>– Image processing fundamentals: convolution, blurring, sharpening, and edge detection.<br>– Histogram equalization and image enhancement techniques. | 6 |
| 2 | **Feature Detection and Extraction**<br>– Corner detection (Harris, FAST), Blob detection (LoG, DoG).<br>– Scale–Invariant Feature Transform (SIFT) and Speeded–Up Robust Features (SURF).<br>– Feature matching and applications in image retrieval.<br>– Hough Transform for shape detection (lines, circles, ellipses). | 9 |

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| 3 | **Object Recognition and Classification**<br>– Template matching and image segmentation techniques.<br>– Machine learning for object detection: Support Vector Machines (SVM), k–NN, Random Forests.<br>– Deep learning–based object detection (YOLO, SSD, Faster R–CNN).<br>– Face recognition techniques: Eigenfaces, Fisherfaces, and deep learning models. | 9 |
| 4 | **Motion and Tracking**<br>– Optical Flow methods: Lucas–Kanade, Horn–Schunck.<br>– Background subtraction techniques for moving object detection.<br>– Kalman Filters and Particle Filters for object tracking.<br>– Human pose estimation and gesture recognition. | 6 |
| 5 | **3D Vision and Augmented Reality**<br>– Stereo vision and depth estimation.<br>– Structure from Motion (SfM) and Visual SLAM (Simultaneous Localization and Mapping).<br>– Augmented Reality (AR) fundamentals and applications.<br>– LiDAR and point cloud processing for 3D object recognition. | 9 |
| 6 | **Ethical Considerations and Future Trends**<br>– Privacy and security concerns in AI–based surveillance.<br>– Bias and fairness in computer vision applications.<br>– Trends in vision transformers and multimodal AI.<br>– Industry best practices for deploying computer vision models in production. | 6 |

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| **Course Title: Introduction to Philosophical Thoughts** | **Code: OEC–IT701B** |
| **Type of Course: Theory** | **Course Designation: Elective** |
| **Semester: 7th** | **Contact Hours: 3L/week** |
| **Continuous Assessment: 25 Marks** | **Final Exam: 70 Marks** |

**COURSE OUTCOMES (COs)**

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

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| **OEC–IT701B.CO1** | Understand the plurality and common concerns in Indian philosophy, with emphasis on Vedic and Upanishadic concepts like Atman, Brahman, Karma, and Turiya. | Understand | K2 |
| **OEC–IT701B.CO2** | Analyze the epistemology, metaphysics, and ethical viewpoints of the Carvaka school, including its concept of Mukti. | Analyze | K4 |
| **OEC–IT701B.CO3** | Examine key Jain philosophical concepts such as anekantavada, syadvada, nayavada, pramanas, ahimsa, bondage, and liberation. | Examine | K4 |
| **OEC–IT701B.CO4** | Evaluate Buddhist philosophical doctrines, including the theory of pramanas, dependent origination, momentariness, and interpretations by different schools (Vaibhasika, Sautrantika, Yogacara, Madhyamika). | Evaluate | K5 |
| **OEC–IT701B.CO5** | Interpret Nyaya philosophy, including its theory of pramanas, individual self, concept of liberation, and proofs for the existence of God. | Interpret | K5 |

**University Syllabus :**

| Unit | Content | Hrs/Unit |
|---|---|---|
| 1 | Nature of Indian Philosophy : Plurality as well as common concerns. 2. Basic concepts of the Vedic and Upanisadic views : Atman, Jagrata,<br>Svapna, Susupti, Turiya, Brahman, Karma, Rta,Rna, | 17 |
| 2 | Carvaka school : its epistemology, metaphysics and ethics. Mukti | 9 |
| 3 | Jainism : Concepts of sat, dravya, guna, paryaya, jiva, ajiva, anekantavada, syadvada, and nayavada ; pramanas, ahimsa, bondage and liberation. | 5 |
| 4 | 5. Buddhism : theory of pramanas, theory of dependent origination, the four noble truths; doctrine of | 5 |

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| | momentaryness; theory of no soul. The interpretation of these theories in schools of Buddhism : Vaibhasika, Sautrantrika, Yogacara, Madhyamika. | |
| 5 | 6. Nyaya : theory of Pramanas; the individual self and its liberation ; the idea of God and proofs for His existence. | 5 |

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| | Programming Problems: Solution of LPP: Using Simultaneous Equations and Graphical Method; Definitions: Feasible Solution, Basic and nonbasic Variables, Basic Feasible Solution, Degenerate and Non– degenerate Solution, Convex set and explanation with examples Solution of LPP by Simplex Method; Charnes' Big–M Method; Duality Theory. Transportation Problems and Assignment Problems. | |
| 2 | Network Analysis:Shortest Path: Floyd Algorithm; Maximal Flow Problem (Ford–Fulkerson); PERTCPM (Cost Analysis, Crashing, Resource Allocation excluded). Inventory Control:Introduction to EOQ Models of Deterministic and Probabilistic ; Safety Stock; Buffer Stock. | 9 |
| 3 | Game Theory: Introduction; 2–Person Zero–sum Game; Saddle Point; Mini–Max and Maxi–Min Theorems (statement only) and problems; Games without Saddle Point; Graphical Method; Principle of Dominance | 5 |
| 4 | Queuing Theory: Introduction; Basic Definitions and Notations; Axiomatic Derivation of the Arrival & Departure (Poisson Queue). Poisson Queue Models: (M/M/1): (∞ / FIFO) and (M/M/1: N / FIFO) and problems. | 5 |

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| **Course Title: Soft Skill & Interpersonal Communication** | **Code: OEC–IT701C** |
| **Type of Course: Theory** | **Course Designation: Elective** |
| **Semester: 7th** | **Contact Hours: 3L/week** |
| **Continuous Assessment: 25 Marks** | **Final Exam: 70 Marks** |

**COURSE OUTCOMES (COs)**

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

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| **OEC–IT701C.CO1** | Analyze personal strengths and weaknesses using SWOT analysis to build self–confidence and self–esteem. | Analyze | K4 |
| **OEC–IT701C.CO2** | Apply creative thinking techniques, including out–of–the–box and lateral thinking, to problem–solving scenarios. | Apply | K3 |
| **OEC–IT701C.CO3** | Understand the factors influencing attitude, motivation, and self–discipline for personal and professional growth. | Understand | K2 |
| **OEC–IT701C.CO4** | Develop goal–setting strategies using SMART goals and time management techniques for effective productivity. | Develop | K4 |
| **OEC–IT701C.CO5** | Assess interpersonal skills, teamwork, and leadership qualities to enhance collaboration in social and professional settings. | Assess | K5 |

**University Syllabus:**

| Unit | Content | Hrs/Unit |
|---|---|---|
| 1 | **SELF ANALYSIS** (2 hours) SWOT Analysis, Who am I, Attributes, Importance of Self Confidence, Self Esteem. | 2 |
| 2 | **CREATIVITY** (3 hours) Out of box thinking, Lateral Thinking. | 3 |
| 3 | **ATTITUDE** (3 hours) Factors influencing Attitude, Challenges and lessons from Attitude, Etiquette. | 3 |
| 4 | **MOTIVATION** (2 hours) Factors of motivation, Self talk, Intrinsic & Extrinsic Motivators. | 4 |
| 5 | **GOAL SETTING** (4 hours) Wish List, SMART Goals, Blueprint for success, Short Term, Long Term, Lifetime Goals. | 4 |
| 6 | **Time management** Value of time, Diagnosing Time Management, Weekly Planner, To do list, Prioritizing work. | 5 |
| 7 | **INTERPERSONAL SKILLS** (6 hours) Understanding the relationship between Leadership, Networking & Teamwork. Assessing Interpersonal Skills, Situation description of Interpersonal Skill. Team Work: Necessity of Team Work Personally, Socially, and Educationally. | 6 |
| 8 | **LEADERSHIP** (2 hours) Skills for a good Leader, Assessment of Leadership Skills. | 2 |
| 9 | **STRESS MANAGEMENT** (4 hours) Causes of Stress and its impact, how to manage & distress, Circle of control, Stress Busters. Emotional Intelligence: What is Emotional Intelligence, emotional quotient, why Emotional Intelligence matters, Emotion Scales, Managing Emotions. | 4 |
| 10 | **CONFLICT RESOLUTION** (2 hours) Conflicts in Human Relations – Reasons, Case Studies, Approaches to conflict resolution. | 2 |
| 11 | **DECISION MAKING** (4 hours) Importance and necessity of Decision Making, Process and practical way of Decision Making, Weighing Positives & Negatives. | 4 |

| Course Title: Project Management and Entrepreneurship | Code: HSMC 701 |
|---|---|
| Type of Course: Theory | Course Designation: Compulsory |
| Semester: 7th | Contact Hours: 2L+1T/week |
| Continuous Assessment: 25 Marks | Final Exam: 70 Marks |

**COURSE OUTCOMES (COs)**

On completion of the course students will be able to

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| HSMC 701.CO1 | Examine role of entrepreneur in economic development | Examine | K3 |
| HSMC 701.CO2 | Describe the steps to establish an enterprise | Describe | K1 |
| HSMC 701.CO3 | Compare and classify types of entrepreneurs | Compare | K4 |
| HSMC 701.CO4 | Evaluate the entrepreneurial support in India | Evaluate | K5 |
| HSMC 701.CO5 | Describe Special institutions for entrepreneurial development and assistance in India | Describe | K1 |
| HSMC 701.CO6 | Explain project Identification | Explain | K6 |

**University Syllabus:**

| Unit | Content | Hrs/Unit |
|---|---|---|
| 1 | ENTREPRENEURSHIP<br>Introduction: Meaning and Concept of Entrepreneurship, Innovation and entrepreneurship, Contributions of entrepreneurs to the society, risk–opportunities perspective and mitigation of risks [2L] | 2 |
| 2 | Entrepreneurship – An Innovation: Challenges of Innovation, Steps of Innovation Management, Idea Management System, Divergent v/s Convergent Thinking, Qualities of a prospective Entrepreneur [2L] | 2 |

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| 3 | Idea Incubation: Factors determining competitive advantage, Market segment, blue ocean strategy, Industry and Competitor Analysis (market structure, market size, growth potential), Demand–supply analysis [4L] | 4 |
| 4 | Entrepreneurial Motivation: Design Thinking – Driven Innovation, TRIZ (Theory of Inventive Problem Solving), Achievement motivation theory of entrepreneurship – Theory of McClelland, Harvesting Strategies [2L] | 2 |
| 5 | Information: Government incentives for entrepreneurship, Incubation, acceleration. Funding new ventures – bootstrapping, crowd sourcing, angel investors, Government of India's efforts at promoting entrepreneurship and innovation – SISI, KVIC, DGFT, SIDBI, Defense and Railways [4L] | 4 |
| 6 | Closing the Window: Sustaining Competitiveness, Maintaining Competitive Advantage, the Changing Role of the Entrepreneur. [2L] | 2 |
| 7 | Applications and Project Reports Preparation [4L] | 4 |
| 8 | PROJECT MANAGEMENT : Definitions of Project and Project Management, Issues and Problems in Project Management, Project Life Cycle – Initiation / Conceptualization Phase, Planning Phase, Implementation / Execution Phase, Closure / Termination Phase [4L] | 4 |
| 9 | Project Feasibility Studies – Pre–Feasibility and Feasibility Studies, Preparation of Detailed Project Report, Technical Appraisal, Economic/Commercial/Financial Appraisal including Capital Budgeting Process, Social Cost Benefit Analysis [2L] | 2 |
| 10 | Project Planning – Importance of Project Planning, Steps of Project Planning, Project Scope, Work Breakdown Structure (WBS) and Organization Breakdown Structure (OBS), Phased Project Planning [2L] | 2 |
| 11 | Project Scheduling and Costing – Gantt chart, CPM and PERT Analysis, Identification of the Critical Path and its Significance, Calculation of Floats and Slacks, Crashing, Time Cost Trade–off Analysis, Project Cost Reduction Methods. [6L] | 6 |
| 12 | Project Monitoring and Control – Role of Project Manager, MIS in Project Monitoring, Project Audit [2L] | 2 |
| 13 | Case Studies with Hands–on Training on MS–Project [4L] | 4 |

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|---|---|
| **Course Title: Project–II** | **Code: PROJ–CS781** |
| **Type of Course: Sessional** | **Course Designation: Compulsory** |
| **Semester: 7th** | **Contact Hours: 12P/week** |
| **Continuous Assessment: 25 Marks** | **Final Exam: 70 Marks** |

**COURSE OUTCOMES (COs)**

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

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| **PROJ–CS781.CO1** | Identify the Problem & Problem Domain in the broad field of Computer Science & Engineering. | Identify | K3 |
| **PROJ–CS781.CO2** | Understand the Research Methodologies and Field Study | Understand | K2 |
| **PROJ–CS781.CO3** | Understand the Tools and Techniques used | Understand | K2 |
| **PROJ–CS781.CO4** | Identify of the Relevant Resources and Data Set | Identify | K3 |
| **PROJ–CS781.CO5** | Prepare of s/w and h/w requirement analysis | Prepare | K6 |
| **PROJ–CS781.CO6** | Develop goal in line with flow of work | Develop | K6 |

**University Syllabus:**

| Unit | Content |
|---|---|
| 1 | **Project work I**<br>The object of Project Work I is to enable the student to take up investigative study in the broad field of Electronics & Communication Engineering, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a Supervisor. This is expected to provide a good initiation for the student(s) in R&D work. |
| 2 | **Project Work II & Dissertation**<br>The object of Project Work II & Dissertation is to enable the student to extend further the investigative study taken up under EC P1, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include: 1. In depth study of the topic assigned in the light of the Report prepared under EC P1; 2. Review and finalization of the Approach to the Problem relating to the assigned topic; 3. Preparing an Action Plan for conducting the investigation, including team work; 4. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed; 5. Final development of product/process, testing, results, conclusions and future directions; 6. Preparing a paper for Conference presentation/Publication in Journals, if possible; 7. Preparing a Dissertation in the standard format for being evaluated by the Department. 8. Final Seminar Presentation before a Departmental Committee. |

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|---|---|---|
| | Programming Problems: Solution of LPP: Using Simultaneous Equations and Graphical Method; Definitions: Feasible Solution, Basic and nonbasic Variables, Basic Feasible Solution, Degenerate and Non– degenerate Solution, Convex set and explanation with examples Solution of LPP by Simplex Method; Charnes' Big–M Method; Duality Theory. Transportation Problems and Assignment Problems. | |

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|---|---|---|
| 2 | Network Analysis:Shortest Path: Floyd Algorithm; Maximal Flow Problem (Ford–Fulkerson); PERTCPM (Cost Analysis, Crashing, Resource Allocation excluded). Inventory Control:Introduction to EOQ Models of Deterministic and Probabilistic ; Safety Stock; Buffer Stock. | 9 |
| 3 | Game Theory: Introduction; 2–Person Zero–sum Game; Saddle Point; Mini–Max and Maxi–Min Theorems (statement only) and problems; Games without Saddle Point; Graphical Method; Principle of Dominance | 5 |
| 4 | Queuing Theory: Introduction; Basic Definitions and Notations; Axiomatic Derivation of the Arrival & Departure (Poisson Queue). Poisson Queue Models: (M/M/1): (∞ / FIFO) and (M/M/1: N / FIFO) and problems. | 5 |

## SEMESTER VII

## LAB

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|---|---|
| **Course Title: Mobile Application Development Lab** | **Code: PCC–CSIT791** |
| **Type of Course: Practical** | **Course Designation: Compulsory** |
| **Semester: 7th** | **Contact Hours: 4P/week** |
| **Continuous Assessment: 40 Marks** | **Final Exam: 60 Marks** |

**COURSE OUTCOMES (COs)**

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

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| PCC–CSIT791.CO1 | Set up and configure the Flutter development environment for iOS and Android. | Configure | K3 |
| PCC–CSIT791.CO2 | Develop interactive mobile applications using Flutter's widget–based UI framework. | Develop | K4 |
| PCC–CSIT791.CO3 | Implement backend services using PHP and integrate MySQL for dynamic data storage. | Implement | K4 |
| PCC–CSIT791.CO4 | Apply authentication and API integration techniques to enable secure and connected applications. | Apply | K4 |
| PCC–CSIT791.CO5 | Deploy and optimize mobile applications for performance, scalability, and security. | Deploy | K5 |

**University Syllabus:**

| Unit | Content |
|---|---|
| 1 | **Setting Up the Development Environment**<br>– Installing Flutter SDK, Dart, Android Studio, and Xcode.<br>– Setting up emulators and physical device debugging.<br>– Understanding Flutter project structure and basic widget usage. |
| 2 | **Frontend Development with Flutter**<br>– Creating UI using Stateless and Stateful widgets.<br>– Implementing layouts: Row, Column, Stack, ListView, GridView.<br>– Managing user inputs with Forms and TextFields.<br>– Handling navigation and routing between screens. |
| 3 | **Backend Development with PHP and MySQL**<br>– Setting up a PHP server and MySQL database.<br>– Performing CRUD operations using PHP and MySQL.<br>– Creating RESTful APIs for Flutter integration.<br>– Testing API responses using Postman. |
| 4 | **API Integration and Authentication**<br>– Consuming RESTful APIs in Flutter using HTTP and Dio packages.<br>– Implementing user authentication with JWT and OAuth.<br>– Secure API communication using HTTPS and token–based authentication. |

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|---|---|
| 5 | **Advanced Mobile App Features**<br>– Integrating Firebase for push notifications and real–time database.<br>– Implementing location services and Google Maps API.<br>– Adding payment gateway support (Razorpay, Stripe, PayPal).<br>– Handling background tasks and scheduled jobs. |
| 6 | **Deployment and Performance Optimization**<br>– Optimizing application performance and reducing app size.<br>– Debugging and logging in Flutter.<br>– Publishing the app on Google Play Store and Apple App Store.<br>– Setting up CI/CD for automated testing and deployment. |

SEMESTER VIII

THEORY

| Course Title: Cryptography and Network Security | Code: PEC–IT801A |
|---|---|
| Type of Course: Theory | Course Designation: Elective |
| Semester: 8th | Contact Hours: 3L/week |
| Continuous Assessment: 25 Marks | Final Exam: 70 Marks |

**COURSE OUTCOMES (COs)**

On completion of the course students will be able to

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| PEC–IT801A.CO1 | Describe conceptual understanding of network security issues, challenges and mechanisms common network vulnerabilities and attacks and basic concept of cryptography. | Describe | K1 |
| PEC– IT801A.CO2 | Evaluate various techniques of cryptography. | Evaluate | K5 |
| PEC– IT801A.CO3 | Illustrate the algorithms of different symmetric key cryptography. | Illustrate | K2 |
| PEC– IT801A.CO4 | Apply the public key algorithms, digital signature and message digest. | Apply | K3 |
| PEC– IT801A.CO5 | Analyze the approaches of security protocol and authentication. | Analyze | K4 |
| PEC– IT801A.CO6 | Explain the concept of electronic mail security and types of firewall and its configurations. | Explain | K2 |

**University Syllabus:**

| Unit | Content | Hrs/Unit |
|---|---|---|
| 1 | Attacks on Computers & Computer Security – Introduction, Need for Security, Security approaches, Principles of Security, Types of attack | 5 |
| 2 | Cryptography: Concepts & Techniques Introduction, Plaintext & Cipher text, Substitution Techniques, Transposition Techniques, Encryption & Decryption, Symmetric & Asymmetric key Cryptography, Key Range & Key Size | 7 |
| 3 | Symmetric Key Algorithm – Introduction, Algorithm types & Modes, Overview of Symmetric Key Cryptography, DES(Data Encryption Standard) algorithm, IDEA(International Data Encryption Algorithm) algorithm, RC5(Rivest Cipher 5) algorithm. | 8 |
| 4 | Asymmetric Key Algorithm, Digital Signature and RSA – Introduction, Overview of Asymmetric key Cryptography, RSA algorithm, Symmetric & Asymmetric key Cryptography together, Digital Signature, Basic concepts of Message Digest and Hash Function (Algorithms on Message Digest and Hash function not required). | 5 |
| 5 | Internet Security Protocols, User Authentication – Basic Concepts, SSL protocol, Authentication Basics, Password, Authentication Token, Certificate based Authentication, Biometric Authentication | 6 |
| 6 | Electronic Mail Security – Basics of mail security, Pretty Good Privacy, S/MIME. | 4 |
| 7 | Firewall – Introduction, Types of firewall, Firewall Configurations, DMZ Network | 3 |

| Course Title: Speech and Natural Language Processing | Code: PEC–IT801B |
|---|---|
| Type of Course: Theory | Course Designation: Elective |
| Semester: 8th | Contact Hours: 3L/week |
| Continuous Assessment: 25 Marks | Final Exam: 70 Marks |

**COURSE OUTCOMES (COs)**

On completion of the course students will be able to

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| PEC–IT801B.CO1 | Understand the fundamentals of Natural Language Processing (NLP), including regular expressions and finite state automata for text processing. | Understand | K2 |
| PEC– IT801B.CO2 | Apply tokenization, normalization, named entity recognition, and spell–checking techniques for text preprocessing. | Apply | K3 |
| PEC– IT801B.CO3 | Implement morphological parsing techniques, including finite state transducers and stemming algorithms. | Implement | K4 |
| PEC– IT801B.CO4 | Analyze language modeling techniques using N–grams, smoothing, and evaluation methods. | Analyze | K4 |
| PEC– IT801B.CO5 | Develop Part–of–Speech (POS) tagging models using Hidden Markov Models (HMM) and machine learning approaches. | Develop | K4 |
| PEC– IT801B.CO6 | Evaluate text classification techniques, sentiment analysis methods, and their applications in opinion mining. | Evaluate | K5 |
| PEC– IT801B.CO7 | Examine context–free grammars, dependency parsing, and probabilistic parsing techniques for syntactic analysis. | Examine | K4 |
| PEC– IT801B.CO8 | Explore lexical semantics, thesaurus–based similarity models, and distributional word representations. | Explore | K3 |
| PEC– IT801B.CO9 | Apply information retrieval techniques, ranking algorithms, and search engine optimization strategies for document retrieval. | Apply | K4 |

**University Syllabus:**

| Unit | Content | Hrs/Unit |
|---|---|---|
| 1 | **Regular Expressions and AutomataRecap)** – Introduction to NLP, Regular Expression, Finite State Automata [2L]<br>**Tokenization** – Word Tokenization, Normalization, Sentence Segmentation, Named Entity Recognition, Multi Word Extraction, Spell Checking – Bayesian Approach, Minimum Edit Distance [5L]<br>**Morphology** – Morphology – Inflectional and Derivational Morphology, Finite State Morphological Parsing, The Lexicon and Morphotactics, Morphological Parsing with Finite State Transducers, Orthographic Rules and Finite State Transducers, Porter Stemmer [4L] | 11 |
| 2 | **Language Modeling** Introduction to N–grams, Chain Rule, Smoothing – Add–One Smoothing, Witten–Bell Discounting; Backoff, Deleted Interpolation, N–grams for Spelling and Word Prediction, Evaluation of language models. [4L]<br>**Hidden Markov Models and POS Tagging** Markov Chain, Hidden Markov Models, Forward Algorithm, Viterbi Algorithm, Part of Speech Tagging – Rule based and Machine Learning based approaches, Evaluation. [4L] | 8 |
| 3 | **Text Classification** Text Classification, Naïve Bayes' Text Classification, Evaluation, Sentiment Analysis – Opinion Mining and Emotion Analysis, Resources and Techniques. [4L]<br>**Context Free Grammar** Context Free Grammar and Constituency, Some common CFG phenomena for English, Top–Down and Bottom–up parsing, Probabilistic Context Free Grammar, Dependency Parsing [4L] | 9 |
| 4 | **Computational Lexical Semantics** Introduction to Lexical Semantics – Homonymy, Polysemy, Synonymy, Thesaurus – WordNet, Computational Lexical Semantics – Thesaurus based and Distributional Word Similarity [4L]<br>**Information Retrieval** Boolean Retrieval, Term– document incidence, The Inverted Index, Query Optimization, Phrase Queries, Ranked Retrieval – Term Frequency – Inverse Document Frequency based ranking, Zone Indexing, Query term proximity, Cosine ranking, Combining different features | 9 |

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| | for ranking, Search Engine Evaluation, Relevance Feedback [5L] | |

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|---|---|
| **Course Title: Internet of Things** | **Code: PEC–IT801C** |
| **Type of Course: Theory** | **Course Designation: Elective** |
| **Semester: 8th** | **Contact Hours: 3L/week** |
| **Continuous Assessment: 25 Marks** | **Final Exam: 70 Marks** |
| **Writer: Course Coordinator** | |

**COURSE OUTCOMES (COs)**

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

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| **PEC–IT801C.CO1** | Understand the vision of IoT from a global context. | Understand | K2 |
| **PEC–IT801C.CO2** | Determine the Market perspective of IoT. | Determine | K5 |
| **PEC–IT801C.CO3** | Use of Devices, Gateways and Data Management in IoT. | Use of | K3 |
| **PEC–IT801C.CO4** | Analysed the use of IoT in Industrial and Commercial Building Automation and Real World Design Constraints. | Analysed | K4 |
| **PEC–IT801C.CO5** | Understand the architecture of smart sensor. | Understand | K2 |
| **PEC–IT801C.CO6** | Build the interfacing among IoT components. | Build | K5 |

**University Syllabus :**

| Unit | Content | Hrs/Unit |
|---|---|---|
| 1 | Environmental Parameters Measurement and Monitoring: Why measurement and monitoring are important, effects of adverse parameters for the living being for IOT | 7 |
| 2 | Sensors: Working Principles: Different types; Selection of Sensors for Practical Applications<br>Introduction of Different Types of Sensors such as Capacitive, Resistive, Surface Acoustic Wave for Temperature, Pressure, Humidity, Toxic Gas etc | 8 |
| 3 | Important Characteristics of Sensors: Determination of the Characteristics<br>Fractional order element: Constant Phase Impedance for sensing applications such as humidity, water quality, milk quality<br>Impedance Spectroscopy: Equivalent circuit of Sensors and Modelling of Sensors<br>Importance and Adoption of Smart Sensors | 11 |
| 4 | Architecture of Smart Sensors: Important components, their features Fabrication of Sensor and Smart Sensor: Electrode fabrication: Screen printing, Photolithography, Electroplating Sensing film deposition: Physical and chemical Vapor, Anodization, Sol–gel | 10 |

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| 5 | Interface Electronic Circuit for Smart Sensors and Challenges for Interfacing the Smart Sensor, Usefulness of Silicon Technology in Smart Sensor And Future scope of research in smart sensor | 7 |
| 6 | Recent trends in smart sensor for day to day life, evolving sensors and their architecture | 5 |

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|---|---|
| **Course Title: Remote Sensing and GIS** | **Code: PEC–IT801D** |
| **Type of Course: Theory** | **Course Designation: Elective** |
| **Semester: 8th** | **Contact Hours: 3L/week** |
| **Continuous Assessment: 25 Marks** | **Final Exam: 70 Marks** |

**COURSE OUTCOMES (COs)**

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

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| PEC–IT801D.CO1 | Understand the fundamentals of Geographic Information Systems (GIS), including its features, functions, and historical development. | Understand | K2 |
| PEC– IT801D.CO2 | Analyze map projections, coordinate systems, and cartographic principles in GIS applications. | Analyze | K4 |
| PEC– IT801D.CO3 | Apply data sources, data input methods, and database management techniques in GIS, ensuring data quality and accuracy. | Apply | K3 |
| PEC– IT801D.CO4 | Implement spatial analysis techniques, including vector and raster–based geographic data processing. | Implement | K4 |
| PEC– IT801D.CO5 | Design and produce maps using GIS software, considering map elements, visualization techniques, and distribution formats. | Design | K5 |
| PEC– IT801D.CO6 | Evaluate the process of GIS implementation, including planning, cost–benefit analysis, data management, and system selection. | Evaluate | K5 |
| PEC– IT801D.CO7 | Explore GIS applications in various domains, integrating emerging technologies and software tools. | Explore | K3 |
| PEC– IT801D.CO8 | Understand remote sensing principles, including electromagnetic spectrum usage, thermal infrared sensing, and environmental applications. | Understand | K2 |

**University Syllabus:**

| Unit | Content | Hrs/Unit |
|---|---|---|
| 1 | Introduction and Overview of Geographic Information Systems Definition of a GIS, features and functions; why GIS is important; how GIS is applied; GIS as an Information System; GIS and cartography; contributing and allied disciplines; GIS data feeds; historical development of GIS. | 3 |
| 2 | GIS and Maps, Map Projections and Coordinate Systems Maps and their characteristics (selection, abstraction, scale, etc.); automated cartography versus GIS; map projections; coordinate systems; | 4 |

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|---|---|---|
| | precision and error. | |
| 3 | Data Sources, Data Input , Data Quality and Database Concepts Major data feeds to GIS and their characteristics: maps, GPS, images, databases, commercial data; locating and evaluating data; data formats; data quality; metadata. Database concepts and components; flat files; relational database systems; data modeling; views of the database; normalization; databases and GIS. | 3 |
| 4 | Spatial Analysis Questions a GIS can answer; GIS analytical functions; vector analysis including topological overlay; raster analysis; statistics; integrated spatial analysis. | 3 |
| 5 | Making Maps Parts of a map; map functions in GIS; map design and map elements; choosing a map type; producing a map formats, plotters and media; online and CD−ROM distribution; interactive maps and the Web. | 6 |
| 6 | Implementing a GIS Planning a GIS; requirements; pilot projects; case studies; data management; personnel and skill sets; costs and benefits; selecting a GIS package; professional GIS packages; desktop GIS; embedded GIS; public domain and lowcost packages. | 4 |
| 7 | Technology & Instruments involved in GIS & Remote Sensing GIS applications; GIS application areas and user segments; creating custom GIS software applications; user interfaces; case studies. Future data; future hardware; future software; Object−oriented concepts and GIS; future issues − data ownership, privacy, education; GIS career options and how to pursue them. | 8 |
| 8 | Remote Sensing Remote sensing of environment, E.M. Principle, Thermal infrared remote sensing, Remote sensing of Vegetation, Remote sensing of water, urban landscape | 8 |

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|---|---|
| **Course Title: Cyber Law and Ethics** | **Code: OEC– IT801B** |
| **Type of Course: Theory** | **Course Designation: Elective** |
| **Semester: 8th** | **Contact Hours: 3L/week** |
| **Continuous Assessment: 25 Marks** | **Final Exam: 70 Marks** |

**COURSE OUTCOMES (COs)**

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

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| **OEC–IT801B.CO1** | Understand the fundamentals of cybercrime, including forgery, hacking, software piracy, and network intrusion. | Understand | K2 |
| **OEC–IT801B.CO2** | Analyze different categories of cybercrime, including passive and active attacks, and the methods used by cybercriminals. | Analyze | K4 |
| **OEC–IT801B.CO3** | Identify security challenges in mobile and wireless devices, including cryptographic security, mobile hacking, and virus attacks. | Identify | K3 |
| **OEC–IT801B.CO4** | Apply knowledge of tools and methods used in cybercrime, such as proxy servers, Trojan horses, DoS/DDoS attacks, and SQL injection. | Apply | K3 |
| **OEC–IT801B.CO5** | Examine phishing techniques and identity theft mechanisms used in online fraud. | Examine | K4 |
| **OEC–IT801B.CO6** | Evaluate legal frameworks, Indian laws, the IT Act, and cybersecurity measures like public key certificates. | Evaluate | K5 |

**University Syllabus :**

| Unit | Content | Hrs/Unit |
|---|---|---|
| 1 | **Introduction of Cybercrime:** What is cybercrime?, Forgery, Hacking, Software Piracy, Computer Network intrusion[4L].<br>**Category of Cybercrime:** how criminals plan attacks, passive attack, Active attacks, cyberstalking.[4L] | 8 |

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|---|---|---|
| 2 | **Cybercrime Mobile & Wireless devices:** Security challenges posted by mobile devices, cryptographic security for mobile devices, Attacks on mobile/cellphones, Theft, Virus, Hacking. Bluetooth; Different viruses on laptop [8L] | 8 |
| 3 | **Tools and Methods used in Cyber crime:** Proxy servers, panword checking, Random checking, Trojan Horses and Backdoors; DOS & DDOS attacks; SQL injection: buffer over flow. [8L] | 8 |
| 4 | **Phishing & Identity Theft:** Phising methods, ID Theft; Online identity method. [4L]<br>**Cybercrime & Cybersecurity:** Legal aspects, indian laws, IT act, Public key certificate. [4L] | 8 |

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|---|---|
| **Course Title: Bioinformatics** | **Code: OEC– IT801D** |
| **Type of Course: Theory** | **Course Designation: Elective** |
| **Semester: 8th** | **Contact Hours: 3L/week** |
| **Continuous Assessment: 25 Marks** | **Final Exam: 70 Marks** |

**COURSE OUTCOMES (COs)**

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

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| **OEC–IT801D.CO1** | Understand the fundamental concepts of molecular biology, including cell structure, organelles, DNA, RNA, and proteins. | Understand | K2 |
| **OEC–IT801D.CO2** | Explain the Central Dogma of molecular biology, including transcription, translation, and metabolic pathways. | Explain | K2 |
| **OEC–IT801D.CO3** | Explore bioinformatics concepts, challenges, and sequence databases like BLAST, FASTA, GenBank, OMIM, and PubMed. | Explore | K3 |
| **OEC–IT801D.CO4** | Analyze DNA sequencing techniques, mapping methods, and alignment algorithms such as Needleman–Wunsch and Smith–Waterman. | Analyze | K4 |
| **OEC–IT801D.CO5** | Apply probabilistic models like Hidden Markov Models (HMM) and Bayesian networks in computational biology. | Apply | K4 |
| **OEC–IT801D.CO6** | Implement classification and clustering techniques for protein function prediction and splice site identification. | Implement | K4 |

**University Syllabus:**

| Unit | Content | Hrs/Unit |
|---|---|---|

| | | |
|---|---|---|
| 1 | **INTRODUCTION TO MOLECULAR BIOLOGY**<br>Concepts of Cell, tissue, types of cell, components of cell, organelle. Functions of different organelles. Concepts of DNA: Basic Structure of DNA; Double Helix structure; Watson and crick model. Exons and Introns and Gene Concept. Concepts of RNA : Basic structure, Difference between RNA and DNA. Types of RNA. Concept of Protein: Basic components and structure. Introduction to Central Dogma: Transcription and Tranlation Introduction to Metabolic Pathways. | 5 |
| 2 | **Sequence Databases** Introduction to Bioinformatics. Recent challenges in Bioinformatics. Protein Sequence Databases, DNA sequence databases. sequence database search programs like BLAST and FASTA.<br>NCBI different modules: GenBank; OMIM, Taxonomy browser, PubMed; | 2 |
| 3 | **DNA SEQUENCE ANALYSIS**<br>DNA Mapping and Assembly : Size of Human DNA<br>,Copying DNA: Polymerase Chain Reaction (PCR), Hybridization and Microarrays, Cutting DNA into Fragments, Sequencing Short DNA Molecules, Mapping Long DNA Molecules. DeBruijn Graph. Sequence Alignment: Introduction, local and global alignment, pair wise and multiple alignment, Dynamic Programming Concept. Alignment algorithms: Needleman and Wunsch algorithm, Smith–Waterman. | 14 |
| 4 | **Introduction Probabilistic models used in Computational Biology**<br>Probabilistic Models; Hidden Markov Model : Concepts, Architecture, Transition matrix, estimation matrix. Application of HMM in Bioinformatics : Genefinding, profile searches, multiple sequence alignment and regulatory site identification. Bayesian networks Model :Architecture,<br>Principle ,Application<br>in Bioinformatics. | 8 |
| 5 | **Biological Data Classification and Clustering**<br>Assigning protein function and predicting splice sites: Decision Tree | 6 |

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|---|---|
| **Course Title: Economic Policies in India** | **Code: OEC– IT802C** |
| **Type of Course: Theory** | **Course Designation: Elective** |
| **Semester: 8th** | **Contact Hours: 3L/week** |
| **Continuous Assessment: 25 Marks** | **Final Exam: 70 Marks** |

**COURSE OUTCOMES (COs)**

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

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| **OEC–IT802C.CO1** | Understand the key determinants of economic development, sustainable growth, and various development indicators such as HDI and PQLI. | Understand | K2 |
| **OEC– IT802C.CO2** | Analyze India's planning strategies, achievements, failures, and the role of grassroots organizations like Panchayats and NGOs in development. | Analyze | K4 |
| **OEC– IT802C.CO3** | Evaluate demographic trends, urbanization patterns, and the challenges of poverty and inequality in India. | Evaluate | K5 |

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| OEC– IT802C.CO4 | Examine the role of infrastructure, energy, education, health, and environmental policies in regional development and economic growth. | Examine | K4 |
| OEC– IT802C.CO5 | Assess the impact of land reforms, agricultural policies, and food security measures on sustainable agricultural development. | Assess | K5 |
| OEC– IT802C.CO6 | Analyze India's industrial policies, privatization trends, and employment generation strategies, including labor market reforms. | Analyze | K4 |
| OEC– IT802C.CO7 | Evaluate fiscal policies, financial sector reforms, and monetary policies in India, including RBI's role and SEBI's regulations. | Evaluate | K5 |
| OEC– IT802C.CO8 | Examine India's foreign trade policies, exchange rate mechanisms, and the impact of globalization and WTO agreements on different sectors. | Examine | K4 |
| OEC– IT802C.CO9 | Explore economic reforms, governance issues, and competition policies, assessing their impact on India's economic landscape. | Explore | K3 |

**University Syllabus :**

| Unit | Content | Hrs/Unit |
|---|---|---|
| 1 | **Economic Development and its Determinants**<br>Approaches to economic development and its measurement – sustainable development; Role of State, market and other institutions; Indicators of development – PQLI, Human Development Index (HDI), gender development indices. | 5 |
| 2 | **Planning in India**<br>Objectives and strategy of planning; Failures and achievements of Plans; Developing grass–root organizations for development – Panchayats, NGOs and pressure groups. | 3 |
| 3 | **Demographic Features, Poverty and Inequality**<br>Broad demographic features of Indian population; rural–urban migration; Urbanization and civic amenities; Poverty and<br>Inequality.<br>**Resource Base and Infrastructure**<br>Energy; social infrastructure – education and health; Environment; Regional imbalance; Issues and policies in financing<br>infrastructure development.<br>**The Agricultural Sector**<br>Institutional Structure – land reforms in India; Technological change in agriculture – pricing of agricultural inputs and output;<br>industry; Agricultural finance policy; Agricultural Marketing and Warehousing; Issues Terms of trade between agriculture<br>and in food security – policies for sustainable agriculture. | 10 |
| 4 | **Section – II**<br>Industrial policy; Public Sector enterprises and their performance; Problem of sick units in India; Privatization and<br>disinvestment debate; Growth and pattern of industrialization; Small–scale sector; Productivity in industrial sector; Exit<br>policy – issues in labour market reforms; approaches for employment generation.<br>Public Finances<br>Fiscal federalism – Centre–State financial relations; Finances of central government; Finances of state governments; Parallel<br>economy; Problems relating to fiscal policy; Fiscal sector reforms in India.<br>Money, Banking and Prices | 15 |

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| | Analysis of price behaviour in India; Financial sector reforms; Interest rate policy; Review of monetary policy of RBI; Money and capital markets; Working of SEBI in India.<br>External Sector<br>Structure and direction of foreign trade; Balance of payments; Issues in export–import policy and FEMA; Exchange rate policy; Foreign capital and MNCs in India; The progress of trade reforms in India.<br>Economic Reforms<br>Rationale of internal and external reforms; Globalization of Indian economy; WTO and its impact on the different sectors of the economy; Need for and issues in good governance; Issues in competition and safety nets in Indian economy. | |

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| **Course Title: Robotics** | **Code: OEC– IT801E** |
| **Type of Course: Theory** | **Course Designation: Elective** |
| **Semester: 8th** | **Contact Hours: 3L/week** |
| **Continuous Assessment: 25 Marks** | **Final Exam: 70 Marks** |

**COURSE OUTCOMES (COs)**

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

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| OEC–IT801E.CO1 | Understand the fundamentals of robotics, including classification, applications, and core elements such as links, joints, actuators, and sensors. | Understand | K2 |
| OEC– IT801E.CO2 | Apply homogeneous transformations, Denavit–Hartenberg (D–H) parameters, and kinematic modeling to represent robot linkages. | Apply | K3 |
| OEC– IT801E.CO3 | Analyze the kinematics of serial and parallel manipulators, including inverse kinematics and workspace calculations. | Analyze | K4 |
| OEC– IT801E.CO4 | Evaluate velocity and static analysis of robotic manipulators using Jacobians, singularity analysis, and force transformation matrices. | Evaluate | K5 |
| OEC– IT801E.CO5 | Implement dynamic modeling techniques using Lagrangian mechanics and simulation tools for serial and parallel manipulators. | Implement | K4 |

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| OEC– IT801E.CO6 | Design and simulate motion planning and control strategies, including PID control, nonlinear control, and force control of manipulators. | Design | K5 |
| OEC– IT801E.CO7 | Examine flexible robotic systems, including modeling and control of flexible links and joints in multi–link robots. | Examine | K4 |
| OEC– IT801E.CO8 | Explore wheeled mobile robots (WMR), their kinematics, dynamics, and motion planning on uneven terrain. | Explore | K3 |
| OEC– IT801E.CO9 | Investigate advanced topics such as chaos in robotic systems, Gough–Stewart platforms, over–constrained mechanisms, and deployable structures. | Investigate | K5 |

**University Syllabus :**

| Unit | Content | Hrs/Unit |
|---|---|---|
| 1 | Introduction :Introduction –– brief history, types, classification and usage, Science and Technology of robots, Some useful websites, textbooks and research journals. | 1 |
| 2 | Elements of robots – links, joints, actuators, and sensors<br>Position and orientation of a rigid body, Homogeneous transformations, Representation of joints, link representation using D–H parameters, Examples of D–H parameters and link transforms, different kinds of actuators – stepper, DC servo and brushless motors, model of a DC servo motor, Types of transmissions, Purpose of sensors, internal and external sensors, common sensors – encoders, tachometers, strain gauge based force–torque sensors, proximity and distance measuring sensors, and vision. | 5 |
| 3 | Kinematics of serial robots Introduction, Direct and inverse kinematics problems, Examples of kinematics of common serial manipulators, workspace of a serial robot, Inverse kinematics of constrained and redundant robots, Tractrix based approach for fixed and free robots and multi–body systems, simulations and experiments, Solution procedures using theory of elimination, Inverse kinematics solution for the general 6R serial manipulator. | 4 |
| 4 | Kinematics of parallel robots Degrees–of–freedom of parallel mechanisms and manipulators, Active and passive joints, Constraint and loop–closure equations, Direct kinematics problem, Mobility of parallel manipulators, Closed–from and numerical solution, Inverse kinematics of parallel manipulators and mechanisms, Direct kinematics of Gough–Stewart platform. | 5 |
| | Velocity and static analysis of robot manipulators Linear and angular velocity of links, Velocity propagation, Manipulator Jacobians for serial and parallel manipulators, Velocity ellipse and ellipsoids, Singularity analysis for serial and parallel manipulators, Loss and gain of degree of freedom, Statics of serial and parallel manipulators, Statics and force transformation matrix of a Gough–Stewart platform, Singularity analysis and statics. | 5 |
| | Dynamics of serial and parallel manipulators Mass and inertia of links, Lagrangian formulation for equations of motion for serial and parallel manipulators, Generation of symbolic equations of motion using a computer,<br>Simulation (direct and inverse) of dynamic equations of motion, Examples of a planar 2R and four–bar mechanism, Recursive dynamics, Commercially available multi–body simulation software (ADAMS) and Computer algebra software Maple. | 4 |
| | Motion planning and control Joint and Cartesian space trajectory planning and generation, Classical control concepts using the example of control of a single link, Independent joint PID control, Control of a multi–link manipulator, Non–linear model based control schemes, Simulation and experimental case studies on serial and parallel manipulators, Control of constrained manipulators, Cartesian control, Force control and hybrid position/force control, Advanced topics in non– linear control of manipulators. 8 Module 8: Modeling And | 6 |
| | Modeling and control of flexible robots Models of flexible links and joints, Kinematic modeling of multi– link flexible robots, Dynamics and control of flexible link manipulators, Numerical simulations results, Experiments with a planar two–link flexible manipulator. | 4 |

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| | Modeling and analysis of wheeled mobile robots 3Introduction and some well known wheeled mobile robots (WMR), two and three–wheeled WMR on flat surfaces, Slip and its modeling, WMR on uneven terrain, Design of slip–free motion on uneven terrain, Kinematics, dynamics and static stability of a three– wheeled WMR's on uneven terrain, Simulations using Matlab and ADAMS. | 3 |
| | Selected advanced topics in robotics Introduction to chaos, Non–linear dynamics and chaos in robot equations, Simulations of planar 2 DOF manipulators, Analytical criterion for unforced motion. Gough– Stewart platform and its singularities, use of near singularity for fine motion for sensing, design of Gough–Stewart platform based sensors. Over– constrained mechanisms and deployable structures, Algorithm to obtain redundant links and joints, Kinematics and statics of deployable structures with pantographs or scissor–like elements (SLE's). | 3 |

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|---|---|
| **Course Title: E–Commerce & ERP** | **Code: OEC–IT802A** |
| **Type of Course: Theory** | **Course Designation: Elective** |
| **Semester: 8th** | **Contact Hours: 3L/week** |
| **Continuous Assessment: 25 Marks** | **Final Exam: 70 Marks** |

**COURSE OUTCOMES (COs)**

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

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| OEC–IT802A.CO1 | Describe the fundamental concept and scope of E–Commerce, relation between E–Commerce and Networking and their concerned hardware. | Describe | K1 |
| OEC–IT802A.CO2 | Explain various business models and E–strategies for developing E–Commerce | Explain | K2 |
| OEC–IT802A.CO3 | Understand the role of Conve1rgence, Collaborative Computing, Content Management & Call Center in E– Commerce and Supply Chain Management | Understand | K2 |
| OEC–IT802A.CO4 | Analyze the mechanism & security issues related to E– Payment and E–Marketing. | Analyze | K4 |
| OEC–IT802A.CO5 | Apply the knowledge of EDI Models and Security Standards in E–Commerce applications. | Apply | K3 |
| OEC–IT802A.CO6 | Elaborate the concept of Enterprise Resource Planning using different ERP Packages | Elaborate | K6 |

**University Syllabus :**

| Unit | Content | Hrs/Unit |
|---|---|---|
| 1 | Overview, Definitions, Advantages & Disadvantages of E – Commerce, Threats of E – Commerce, Managerial Prospective, Rules & Regulations For Controlling E – Commerce, Cyber Laws. [ 3 L ] | 3 |
| 2 | Technologies : Relationship Between E – Commerce & Networking, Different Types of Networking Commerce, Internet, Intranet & Extranet, EDI Systems Wireless Application Protocol : Definition, Hand Held Devices, Mobility & Commerce, Mobile Computing, Wireless Web, Web Security, Infrastructure Requirement For E – Commerce . [ 5 L ] | 5 |
| 3 | Business Models of e – commerce : Model Based On Transaction Type, Model Based On Transaction Party – B2B, B2C, C2B, C2C, E – Governance. [2 L ] | 2 |
| 4 | E – strategy : Overview, Strategic Methods for developing E – commerce. [2 L ] | 2 |
| 5 | Four C's : ( Convergence, Collaborative Computing, Content Management & Call Center ). Convergence : Technological Advances in Convergence – Types, Convergence and its implications, Convergence & Electronic Commerce. Collaborative Computing : Collaborative product development, contract as per CAD, Simultaneous Collaboration, Security. Content Management : Definition of content, Authoring Tools & Content Management, Content – partnership, repositories, convergence, providers, Web Traffic & Traffic Management ; Content Marketing. Call Center : Definition, Need, Tasks Handled, Mode of Operation, Equipment , Strength & Weaknesses of Call Center, Customer Premises Equipment (CPE). [ 6 L ] | 6 |
| 6 | Supply Chain Management : E – logistics, Supply Chain Portal, Supply Chain Planning Tools (SCP Tools), Supply Chain Execution (SCE), SCE – Framework, Internet's effect on Supply Chain Power. [ 3 L ] | 3 |
| 7 | E – Payment Mechanism : Payment through card system, E – Cheque, E – Cash, E – Payment Threats & Protections. [ 1 L ] | 1 |
| 8 | E – Marketing :. Home –shopping, E–Marketing, Tele–marketing [ 1 L ] | 1 |
| 9 | Electronic Data Interchange (EDI) : Meaning, Benefits, Concepts, Application, EDI Model, Protocols (UN EDI FACT / GTDI, ANSI X – 12), Data Encryption (DES / RSA). [2 L ] | 2 |

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|---|---|---|
| 10 | Electronic Data Interchange (EDI) : Meaning, Benefits, Concepts, Application, EDI Model, Protocols (UN EDI FACT / GTDI, ANSI X – 12), Data Encryption (DES / RSA). [2 L ] | 2 |
| 11 | Risk of E – Commerce : Overview, Security for E – Commerce, Security Standards, Firewall, Cryptography, Key Management, Password Systems, Digital certificates, Digital signatures. [4 L ] | 4 |
| 12 | Enterprise Resource Planning (ERP) : Features, capabilities and Overview of Commercial Software, re–engineering work processes for IT applications, Business Process Redesign, Knowledge engineering and data warehouse . Business Modules: Finance, Manufacturing (Production), Human Resources, Plant Maintenance, Materials Management, QualityManagement, Sales&Distribution ERPPackage, ERP Market: ERP Market Place, SAP AG, PeopleSoft, BAAN, JD Edwards, Oracle Corporation ERP–Present and Future:<br>Enterprise Application Integration (EAI), ERP and E–Commerce, ERP and Internet, Future Directions in ERP [10] | 10 |

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|---|---|
| Course Title: Micro–electronics and VLSI Design | Code: OEC–IT802B |
| Type of Course: Theory | Course Designation: Elective |
| Semester: 8th | Contact Hours: 3L/week |
| Continuous Assessment: 25 Marks | Final Exam: 70 Marks |

**COURSE OUTCOMES (COs)**

On completion of the course students will be able to

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| OEC–IT802B.CO1 | Understand the fundamentals of CMOS circuits, including MOS transistors, logic gates, and memory components. | Understand | K2 |
| OEC–IT802B.CO2 | Analyze CMOS fabrication techniques, including wafer processing, oxidation, ion–implantation, and different CMOS processes. | Analyze | K4 |
| OEC–IT802B.CO3 | Apply layout design rules for CMOS circuits, including n–well rules, layer assignments, and Silicon–On–Insulator (SOI) design considerations. | Apply | K3 |
| OEC–IT802B.CO4 | Evaluate power dissipation mechanisms in CMOS circuits, including static, dynamic, and short–circuit dissipation. | Evaluate | K5 |
| OEC–IT802B.CO5 | Implement programmable logic structures, reconfigurable gate arrays, and FPGA–based digital designs using RTL synthesis. | Implement | K4 |
| OEC–IT802B.CO6 | Design and optimize VLSI circuit placement using min–cut algorithms, iterative improvement, and simulated annealing techniques. | Design, Optimize | K5 |
| OEC–IT802B.CO7 | Examine routing techniques such as segmented channel routing, maze routing, and net delay analysis for VLSI circuit layouts. | Examine | K4 |
| OEC–IT802B.CO8 | Explore verification and testing methodologies, including logic simulation, timing verification, ATPG, and design for testability in FPGAs. | Explore | K3 |
| OEC–IT802B.CO9 | Develop digital designs using VHDL for behavioral synthesis and RTL–based hardware description. | Develop | K4 |

**University Syllabus :**

| Unit | Content | Hrs/Unit |
|---|---|---|
| 1 | Introduction to CMOS circuits: MOS Transistors, MOS transistor switches, CMOS Logic, The inverter, Combinational Logic, NAND gate, NOT Gate, Compound Gates, Multiplexers, Memory–Latches and Registers. [6L] | 6 |
| 2 | Processing Technology: Silicon Semiconductor Technology– An Overview, wafer processing, oxidation, epitaxy deposition, Ion–implantation and diffusion, The Silicon Gate Process– Basic CMOS Technology, basic n–well CMOS process, p–well CMOS process, Twin tub process, Silicon on insulator, CMOS process enhancement–Interconnect, circuit elements, 3–D CMOS. Layout Design Rule: Layer Representations, CMOS n–well Rules, Design Rule of background scribe line, Layer Assignment, SOI Rule [10L] . | 10 |
| 3 | Power Dissipation: Static dissipation, Dynamic dissipation, short–circuit dissipation, total power dissipation. Programmable Logic, Programmable Logic structure, Programmable interconnect, and Reprogramable | 8 |

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|---|---|---|
| | Gate Array: Xilinx Programmable Gate Array, Design Methods: Behavioural Synthesis, RTL synthesis [8L] | |
| 4 | Placement: placement: Mincut based placement – Iterative improvement placement simulated annealing. Routing: Segmented channel routing – maze routing – routability and routing resources – net delays. [5L] | 5 |
| 5 | Verification and Testing: Verification Versus Testing, Verification: logic simulation design validation – timing verification – Testing concepts: failures – mechanisms and faults – fault coverage – ATPG methods – types of tests – FPGAs – programmability failures – design for testability. [5L] | 5 |
| 6 | Overview of VHDL [5L] | 5 |

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| **Course Title: Data Analytics** | **Code: OEC–CSIT802A** |
| **Type of Course: Theory** | **Course Designation: Elective** |
| **Semester: 8th** | **Contact Hours: 3L/week** |
| **Continuous Assessment: 25 Marks** | **Final Exam: 70 Marks** |

**COURSE OUTCOMES (COs)**

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

| Course Outcomes | Details | Action Verb | Knowledge Level |
|---|---|---|---|
| **CO1** | Understand the fundamental concepts of data analytics, types of data, and its significance in modern industries. | Understand | K2 |
| **CO2** | Apply statistical methods and data preprocessing techniques to clean and analyze raw data. | Apply | K3 |
| **CO3** | Develop skills in data visualization using libraries such as Matplotlib and Seaborn for effective data representation. | Develop | K4 |
| **CO4** | Implement machine learning algorithms for predictive analytics and data–driven decision–making. | Implement | K4 |
| **CO5** | Evaluate big data technologies, frameworks (Hadoop, Spark), and their application in large–scale data processing. | Evaluate | K5 |
| **CO6** | Design and implement real–world data analytics projects for business intelligence and scientific research. | Design | K6 |

**University Syllabus:**

| Unit | Content | Hours/Unit |
|---|---|---|
| 1 | Introduction to Data Analytics<br>– Overview of Data Analytics and its Applications in Industry<br>– Types of Data: Structured, Unstructured, Semi–structured<br>– Data Analytics Process: Data Collection, Cleaning, Processing, and Analysis | 6 |

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|---|---|---|
| | – Data Lifecycle and Role of Data Analysts | |
| 2 | Data Preprocessing and Statistical Analysis<br>– Handling Missing Data, Outliers, and Data Normalization<br>– Descriptive and Inferential Statistics: Mean, Median, Mode, Variance, Standard Deviation<br>– Probability Distributions and Hypothesis Testing<br>– Correlation and Regression Analysis | 6 |
| 3 | Data Visualization Techniques<br>– Introduction to Data Visualization and Importance<br>– Tools and Libraries: Matplotlib, Seaborn, Tableau, Power BI<br>– Creating Line Charts, Bar Charts, Histograms, and Scatter Plots<br>– Interactive Dashboards and Storytelling with Data | 8 |
| 4 | Machine Learning for Data Analytics<br>– Introduction to Supervised and Unsupervised Learning<br>– Regression Models (Linear, Logistic), Decision Trees, and Random Forests<br>– Clustering (K–Means, Hierarchical Clustering)<br>– Performance Evaluation Metrics (Precision, Recall, F1–Score) | 8 |
| 5 | Big Data Analytics and Technologies<br>– Introduction to Big Data: Characteristics and Challenges<br>– Hadoop Ecosystem: HDFS, MapReduce, YARN<br>– Apache Spark: Architecture, RDDs, and DataFrames<br>– NoSQL Databases for Data Analytics (MongoDB, Cassandra) | 8 |
| 6 | Real–World Applications and Case Studies<br>– Business Intelligence and Decision Making<br>– Sentiment Analysis and Social Media Analytics | 4 |