**CURRICULUM STRUCTURE**

**and**

**DETAILED SYLLABI**

for

Four Year UG Programme

**B. Tech.**

**Computer Science & Engineering**

*(Applicable for batches admitted from 2020)*

**Department of Computer Science & Engineering**

**University College of Engineering (A), JNTU Kakinada**

**R20- Bachelor of Technology**

**Course Structure & Syllabi**

**Vision and Mission of the Institute**

**Vision**

To be a premier institute of excellence developing highly talented holistic human capital that contributes to the nation through leadership in technology and innovation through engineering education.

**Mission**

1. To impart Personnel Skills and Ethical Values for Sustainable Development of the Nation.

2. To create Research & Industry oriented centers of excellence in all engineering disciplines.

3. To be a renowned IPR generator and repository for innovative technologies.

4. To develop Research and Industry oriented technical talent.

5. To benchmark globally the academic & research output.

**Vision and Mission of the Computer Science and Engineering Department**

**Vision**

Department of Computer Science and Engineering strives rigorously to create intellectual academic environment with global standards that fosters the search for new knowledge in a highly dynamic computing-centric society through applied research.

**Mission**

1. To Provide quality education in both theoretical and applied foundations of computer science and train the students to solve the real world problems effectively thus enhancing their potential for high quality careers.
2. To facilitate the students and faculty to inculcate the research culture to advance the state-of art of computer science and integrate research innovations in multi-disciplinary fields.
3. To equip students and faculty with excellent teaching-learning capabilities through advanced learning tools and technologies
4. To produce students with critical thinking and lifelong learning capabilities for applying their knowledge to uplift the living standards of the society.
5. To produce students with enriched skill set, professional behaviour, strong ethical values and leadership capabilities so as to work with commitment for the progress of the nation.

**Programme Education Objectives (PEOs)**

1. Competent IT professional with sound fundamental and applied knowledge in Computer Science and Engineering.
2. Sustained learner to bring out creative and innovative ideas to meet the challenges of industry and society with ethics and human values and pursue the higher studies.
3. Entrepreneurs in computer science acquainted interpersonal, managerial skills to make them successful in multidisciplinary fields.

**Programme Outcomes (POs)**

1. Acquire in-depth knowledge of core discipline such as Algorithms and data structures, databases, networking, mobile applications and security.
2. Analyze and synthesis the complex computer science engineering problems with their sound applied knowledge and critical thinking.
3. Solve and arrive at optimal solutions for societal and environmental problems with core expertise and lateral thinking.
4. Develop higher order thinking and innovative ideas to solve unknown problems through the application of appropriate methods, techniques and tools.
5. Learn and Work in competing open ended environment with modern engineering and IT tools.
6. Obtain knowledge in cutting edge technologies to contribute positively towards collaborative multidisciplinary problem solving.
7. Acquire leadership skills and project management techniques to manage projects efficiently to work in teams.
8. Present their knowledge and ideas effectively in any technical forum through the effective design of documents and reports.
9. Engage in lifelong learning independently with commitment to acquire knowledge of contemporary issues to meet the challenges in career.
10. Realize professional and ethical responsibility and act in accordance to social welfare.

**Program Specific Outcomes for B.Tech(CSE)**

**PSO1:** Ability to acquire the fundamental knowledge and practical competence of computer Science and Engineering.

**PSO2:**Able to provide socially acceptable technical solutions to complex core problems with the application of modern tools and techniques.

**PSO3:** Be employed as an engineering professional beyond entry level position with team work abilities.

**PSO4:** Be able to route their professional expertise to pursue higher studies and research programs.

**Mapping of Mission statements to PEOs**

|  |  |  |  |
| --- | --- | --- | --- |
| **Key components From Department**  **Mission** | **PEO 1** | **PEO 2** | **PEO 3** |
| M1. To Provide quality education in both theoretical and applied foundations of computer science and train the students to solve the real world problems effectively thus enhancing their potential for high quality careers.  M2.To facilitate the students and faculty to inculcate the research culture to advance the state-of art of computer science and integrate research innovations in multi-disciplinary fields.  M3.To equip students and faculty with excellent teaching-learning capabilities through advanced learning tools and technologies  M4.To produce students with critical thinking and lifelong learning capabilities for applying their knowledge to uplift the living standards of the society.  M5.To produce students with enriched skill set, professional behaviour, strong ethical values and leadership capabilities so as to work with commitment for the progress of the nation. | Competent IT professional with sound fundamental and applied knowledge in Computer Science and Engineering. | Sustained learner to bring out creative and innovative ideas to meet the challenges of industry and society with ethics and human values and pursue the higher studies. | Entrepreneurs in computer science acquainted interpersonal, managerial skills to make them successful in multidisciplinary fields. |
| ***Quality education*** | **High** | **High** | **Medium** |
| ***Research*** | **Medium** | **High** | **Low** |
| **Teaching­Learning** | **Medium** | **High** | **Medium** |
| ***Sustained Learning*** | **High** | **High** | **Medium** |

**Graduate Attributes (GAs)**

|  |
| --- |
| Scholarship of Knowledge |
| Critical Thinking |
| Problem Solving |
| Research Skills |
| Usage of Modern Tools |
| Multidisciplinary Work |
| Project Management & Finance |
| Communication |
| Lifelong Learning |
| Ethical practices & Social Responsibilities |

**Mapping of Programme Outcomes to PEOs**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **PEO** |  | **PROGRAM OUTCOMES** | | | | | | | | |
| PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
| **PEO 1** | 3 | 3 | 3 | 2 | 3 | 3 | 1 | 2 | 2 | 2 |
| **PEO 2** | 2 | 2 | 3 | 3 | 2 | 3 | 1 | 2 | 3 | 3 |
| **PEO 3** | 2 | 1 | 1 | 1 | 2 | 3 | 3 | 3 | 1 | 1 |

**Mapping of Programme Outcomes to GAs**

|  |  |
| --- | --- |
| **POs** | **Graduate Attributes** |
| **PO1** | Scholarship of Knowledge |
| **PO2** | Critical Thinking |
| **PO3** | Problem Solving |
| **PO4** | Research Skills |
| **PO5** | Usage of Modern Tools |
| **PO6** | Multidisciplinary Work |
| **PO7** | Project Management & Finance |
| **PO8** | Communication |
| **PO9** | Lifelong Learning |
| **PO10** | Ethical practices & Social Responsibilities |

**B.Tech Programme Course Structure & Syllabus**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **1st B.Tech 1st sem** | | | | | | |
| **Sl. No.** | **Course Code** | **Course Title (Proposed)** | **Hours per week** | | | **Credits** |
|  |  |  | **L** | **T** | **P** | **C** |
| 1 | R20BS1101 | Mathematics - I | 3 | 0 | 0 | 3 |
| 2 | R20BS1102 | Applied Chemistry | 3 | 0 | 0 | 3 |
| 3 | R20HS1101 | Communicative English | 3 | 0 | 0 | 3 |
| 4 | R20ES1101 | Computer Engineering Workshop | 1 | 0 | 4 | 3 |
| 5 | R20ES1102 | Problem solving and Programming using C | 3 | 0 | 0 | 3 |
| 6 | R20HS1102 | English Communications skills Lab | 0 | 0 | 3 | 1.5 |
| 7 | R20BS1103 | Applied Chemistry Lab | 0 | 0 | 3 | 1.5 |
| 8 | R20ES1103 | Problem solving and Programming using C lab | 0 | 0 | 3 | 1.5 |
| 9 | R20MC1101 | Yoga & Physical Fitness Activities | 0 | 0 | 2 | 0 |
| **Total credits** | | | | | | **19.5** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **1st B.Tech 2nd sem** | | | | | | |
| **Sl. No.** | **Course Code** | **Course Title (Proposed)** | **Hours per week** | | | **Credits** |
|  |  |  | **L** | **T** | **P** | **C** |
| 1 | R20BS1201 | Mathematics – II | 3 | 0 | 0 | 3 |
| 2 | R20BS1202 | Applied Physics | 3 | 0 | 0 | 3 |
| 3 | R20ES1201 | Computer Organization | 3 | 0 | 0 | 3 |
| 4 | R20ES1202 | Data Structures | 3 | 0 | 0 | 3 |
| 5 | R20ES1203 | Object Oriented Programming Through C++ | 3 | 0 | 0 | 3 |
| 6 | R20ES1204 | Data Structures lab | 0 | 0 | 3 | 1.5 |
| 7 | R20BS1203 | Applied Physics Lab | 0 | 0 | 3 | 1.5 |
| 8 | R20ES1205 | Object Oriented Programming Through C++ lab | 0 | 0 | 3 | 1.5 |
| 9 | R20BS1204 | Applied Physics Virtual Laboratory | 0 | 0 | 2 | 0 |
| 10 | R20MC101 | **Constitution of India (AICTE suggested)** | 2 | 0 | 0 | 0 |
| 11 | R20PR1201 | Engineering Exploration Project- Design Thinking | 0 | 0 | 1 | 0 |
| **Total credits** | | | | | | **19.5** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **2nd B.Tech 1st sem** | | | | | | |
| **Sl. No.** | **Course Code** | **Course Title (Proposed)** | **Hours per week** | | | **Credits** |
|  |  |  | **L** | **T** | **P** | **C** |
| 1 | R20BS2101 | Mathematics – III | 3 | 0 | 0 | 3 |
| 2 | R20PC2101 | MFCS | 3 | 0 | 0 | 3 |
| 3 | R20PC2102 | Operating Systems | 3 | 0 | 0 | 3 |
| 4 | R20PC2103 | Python Programming | 3 | 0 | 0 | 3 |
| 5 | R20PC2104 | Data Base Management Systems | 3 | 0 | 0 | 3 |
| 6 | R20PC2105 | Data Base Management Systems lab | 0 | 0 | 3 | 1.5 |
| 7 | R20PC2106 | Operating Systems & LINUX Lab | 0 | 0 | 3 | 1.5 |
| 8 | R20PC2107 | Python Programming Lab | 0 | 0 | 3 | 1.5 |
| 9 | R20SO2101 | Mobile App Development | 0 | 0 | 4 | 2 |
| 10 | R20MC2101 | Research Methodology | 2 | 0 | 0 | 0 |
| **Total credits** | | | | | | **21.5** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **2nd B.Tech 2nd sem** | | | | | | |
| **Sl. No.** | **Course Code** | **Course Title (Proposed)** | **Hours per week** | | | **Credits** |
|  |  |  | **L** | **T** | **P** | **C** |
| 1 | R20BS2201 | Probability and Statistics | 3 | 0 | 0 | 3 |
| 2 | R20ES2201 | Formal Languages and Automata theory | 3 | 0 | 0 | 3 |
| 3 | R20PC2201 | Computer Networks | 3 | 0 | 0 | 3 |
| 4 | R20PC2202 | Advanced Java Programming | 3 | 0 | 0 | 3 |
| 5 | R20HS2201 | Managerial Economics and Financial Accountancy | 3 | 0 | 0 | 3 |
| 6 | R20PC2203 | R Programming lab | 0 | 0 | 3 | 1.5 |
| 7 | R20PC2204 | Advanced Java Programming Lab | 0 | 0 | 3 | 1.5 |
| 8 | R20PC2205 | CN Lab | 0 | 0 | 3 | 1.5 |
| 9 | R20 SO2201 | Python Programming: NLP | 0 | 0 | 4 | 2 |
| **Total credits** | | | | | | **21.5** |
| **Internship 2 Months (Mandatory) during summer vacation** | | | | | | |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **3rd B.Tech 1st sem** | | | | | | |
| **Sl. No.** | **Course Code** | **Course Title (Proposed)** | **Hours per week** | | | **Credits** |
|  |  |  | **L** | **T** | **P** | **C** |
| 1 | PC | Compiler Design | 3 | 0 | 0 | 3 |
| 2 | PC | Design analysis of algorithms | 3 | 0 | 0 | 3 |
| 3 | PC | Data Mining and Data Warehousing | 3 | 0 | 0 | 3 |
| 4 | OE/Job oriented elective | Open Elective-I | 3 | 0 | 0 | 3 |
| 5 | PE | Professional Elective-I   1. Artificial Intelligence 2. Software project Management 3. Distributed systems 4. Advanced Unix Programming | 3 | 0 | 0 | 3 |
| 6 | PC lab | Data Mining and Data Warehousing lab | 0 | 0 | 3 | 1.5 |
| 7 | PC lab | Compiler Design lab | 0 | 0 | 3 | 1.5 |
| 8 | Skill oriented | Animation course: Animation Design | 0 | 0 | 4 | 2 |
| 9 | MC | Empolyability skills-I \* | 2 | 0 | 0 | 0 |
| 10 | PR | **Summer Internship 2 Months (Mandatory) after second year (to be evaluated during V semester** | 0 | 0 | 0 | 1.5 |
| **Total credits** | | | | | | **21.5** |
| **Honors/Minor courses** | | | **4** | **0** | **0** | **4** |
| **Honors/Minor courses** | | | **4** | **0** | **0** | **4** |
| **\*Internal evaluation** | | |  |  |  |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **3rd B.Tech 2nd sem** | | | | | | |
| **Sl. No.** | **Course Code** | **Course Title (Proposed)** | **Hours per week** | | | **Credits** |
|  |  |  | **L** | **T** | **P** | **C** |
| 1 | PC | Machine Learning using PYTHON | 3 | 0 | 0 | 3 |
| 2 | PC | Big Data Analytics | 3 | 0 | 0 | 3 |
| 3 | PC | Cryptography & Network Security | 3 | 0 | 0 | 3 |
| 4 | PE | Professional Elective-II   1. Mobile Computing 2. Mean Stack Development 3. Object oriented Programming and Design 4. Network Programming | 3 | 0 | 0 | 3 |
| 5 | Open Elective/  Job oriented skill | Open Elective-II | 3 | 0 | 0 | 3 |
| 6 | PC Lab | Big Data Analytics Lab | 0 | 0 | 3 | 1.5 |
| 7 | PC Lab | Machine Learning using PYTHON | 0 | 0 | 3 | 1.5 |
| 8 | PC Lab | Cryptography & Network Security | 0 | 0 | 3 | 1.5 |
| 9 | Skill oriented | Data Science: natural Language Processing / APSSDC suggested courses | 0 | 0 | 4 | 2 |
| 10 | MC | Empolyability skills-II \* | 2 | 0 | 0 | 0 |
| **Total credits** | | | | | | **21.5** |
| **Industrial/Research Internship (Mandatory) 2 Months during summer vacation** | | | | | | |
| **Honors/Minor courses** | | | **4** | **0** | **0** | **4** |
| **Honors/Minor courses through SWAYAM** | | | **2** | **0** | **0** | **2** |
| **\*Internal evaluation** | | |  |  |  |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **4th B.Tech 1st sem** | | | | | | |
| **Sl. No.** | **Course Code** | **Course Title (Proposed)** | **Hours per week** | | | **Credits** |
|  |  |  | **L** | **T** | **P** | **C** |
| 1 | PE | Professional Elective-III   1. Cloud computing 2. Neural Networks and Soft Computing 3. Ad-hoc and Sensor Networks 4. Cyber Security & forensics | 3 | 0 | 0 | 3 |
| 2 | PE | Professional Elective-IV   1. Social Networks & Semantic web 2. Deep Learning Techniques 3. Information security Audit 4. MOOCS-NPTEL/SWAYAM\* | 3 | 0 | 0 | 3 |
| 3 | PE | Professional Elective-V   1. Block-Chain Technologies 2. Wireless Network Security 3. Ethical Hacking 4. MOOCS-NPTEL / SWAYAM \* | 3 | 0 | 0 | 3 |
| 4 | Open/Job Oriented skills | Open Elective-III | 2 | 0 | 2 | 3 |
| 5 | Open / Job Oriented skills | Open Elective-IV | 2 | 0 | 2 | 3 |
| 6 | HSS elective | Universal Human Values 2: Understanding Harmony | 3 | 0 | 0 | 3 |
| 7 | Skill | PYTHON: Deep Learning / APSSDC offered courses | 0 | 0 | 4 | 2 |
| 8 | PR | **Industrial/Research Internship 2 Months (Mandatory) after third year (to be evaluated during VII semester** | 0 | 0 | 0 | 3 |
| **Total credits** | | | | | | **23** |
| **Honors/Minor courses** | | | **4** | **0** | **0** | **4** |
| **Honors/Minor courses through SWAYAM** | | | **2** | **0** | **0** | **2** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **4th B.Tech 2nd sem** | | | | | | |
| **Sl. No.** | **Course Code** | **Course Title (Proposed)** | **Hours per week** | | | **Credits** |
|  |  |  | **L** | **T** | **P** | **C** |
| 1 | PR | Project  Project work, seminar and internship in industry | 0 | 0 | 0 | 12 |
| **Total credits** | | | | | | **12** |

|  |  |  |  |
| --- | --- | --- | --- |
| **Component** | **Remarks** | **APSCHE** | **JNTUK** |
| HSSMS | English, MEFA, MS | **7.5+1.5(HSS Elective)** | **9** |
| BS | Maths, Physics and Chemistry | **21** | **21** |
| ES | Workshop, Drawing, Basics of Electrical/Mechanical/Computers | **22.5** | **22.5** |
| PC | Departmental Core **(PCC)** | **52.5** | **52.5** |
| PE | Departmental Electives **(PE)** | **15** | **15** |
| OE | Open Electives | **12** | **12** |
| Proj | Project Work, Internships, Seminar, APSSDC etc | **16.5** | **16.5** |
| **skill** |  | **10** | **10** |
| **Total Credits** |  | **160** | **160** |
| **Minor’s** |  | **20(4\*4+2+2)** | **20** |
| **Honor’s** |  | **20** | **20** |

***Open Electives to be offered by CSE for Other Branches:***

|  |  |
| --- | --- |
| **Open Elective-I:**   1. Data Structures 2. Java Programming 3. Data Base Management Systems 4. Computer Graphics 5. C++ Programming 6. Advanced unix programming | **Open Elective-II:**   1. Operating Systems 2. Python Programming 3. Web Technologies 4. Soft Computing 5. Distributed Computing 6. AI and ML for Robotics |
| **Open Elective-III:**   1. Big Data Analystics 2. AI Tools & Techniques 3. Image Processing 4. Information Security 5. Mobile Application Development 6. Cloud computing | **Open Elective-IV:**   1. Cyber Security 2. Deep Learning 3. Data Science 4. Block Chain Technologies 5. Game Theory 6. Internet of Things |

***Open Electives to be offered by Other Departments for Computer Science & Engineering***

|  |  |
| --- | --- |
| **Electronics &Communication Engineering**   1. Information Coding Theory 2. VLSI 3. Signals &Systems 4. Digital Signal Processing 5. Medical Image Processing 6. RFID, Sensors &Data Acquisition | **Mathematics**   1. Optimization Techniques 2. Statistics with R 3. Cryptography, number theory and Cryptanalysis 4. Fuzzy Sets, Logic and Systems |
| **Electronics and Electronics Engineering**   1. Network Analysis 2. Fuzzy Systems & Controllers 3. Green Energy Models 4. Power Systems for Data Centers 5. Power Safety and Management | **Civil Engineering**   1. Intelligent transportation Engineering 2. Geospatial Systems(GIS, Remote Sensing etc.,) 3. Engineering Mechanics 4. Smart City Planning 5. Smart & Safety Building Design |
| **Mechanical Engineering**   1. Industrial Management 2. Robotics and Autonomous Driving Systems 3. CAD and MATLAB 4. Basics of Mechatronics 5. Alternative Energy Systems |  |

**Honors Courses**

**(Tentative- list can be appended)**

**Note 1. The subjects opted for Honors should be Advanced type which are**

**not covered in regular curriculum**

* 1. **Students has to acquire 16 credits with minimum one subject from each pool.**
  2. **Concerned BoS can add or delete the subjects as per the decision of the board.**
  3. **Pre requisites to be defined by the board for each course.**
  4. **Compulsory MOOC/NPTEL Courses for 04 credits (02 courses@ 2 credits each)**

|  |  |
| --- | --- |
| **POOL1**   1. Advanced Computer Architecture   2.Operating Systems Administration and Security  3. E-Commerce  4.Information Retrieval Systems | **POOL** **2**   1. Social Mobile Analytics & Cloud 2. Security Governance Risk and compliance   3.Parallel Computing  4.Distributed data bases |
| **POOL3**   1. Cloud and IoT Security 2. No SQL Databases 3. Soft computing 4. Social Networks & Semantic Web | **POOL4**   1. Digital Marketing 2. Wireless Networks Security   3.High performance Computing  4. Enterprise Storage Systems |

**MOOCs - SWAYAM/NPTEL Honor’s Course list for 04 credits (02 courses@ 2 credits each)**

**(Tentative - list can be appended)**

**Note: Students need to select the courses which were not offered in their regular programme and minor tracks**

|  |  |  |  |
| --- | --- | --- | --- |
| **S.NO** | **COURSE NAME** | **UG-Core/Elective** | **Type of Course** |
| 1 | User-centric Computing for Human-Computer Interaction | Elective | Rerun |
| 2 | Information Security - 5 - Secure Systems Engineering | Elective | Rerun |
| 3 | AI: Constraint Satisfaction | Elective | Rerun |
| 4 | Privacy and Security in Online Social Media | Elective | Rerun |
| 5 | Data Science for Engineers | Elective | Rerun |
| 6 | Embedded System Design with ARM | Elective | Rerun |

**GENERAL MINOR TRACKS**

**Note 1. The student can opt any 4 subjects from each pool.**

1. **Concerned BoS can add or delete the subjects as per the decision of the board.**
2. **Pre requisites to be defined by the board for each course.**
3. **Compulsory MOOC/NPTEL Courses for 04 credits (02 courses@ 2 credits each)**

**Department of Mechanical Engineering**

1. **Students need to select the courses which were not offered in their regular programme.**

|  |  |  |  |
| --- | --- | --- | --- |
| **S.No** | **Subject** | **L-T-P** | **Credit** |
| **1** | Operating systems | **3-1-0** | **4** |
| **2** | Data Structures Using C | **3-1-0** | **4** |
| **3** | Computer organization and Architecture | **3-1-0** | **4** |
| **4** | Software Engineering | **3-1-0** | **4** |
| **5** | Design and analysis of algorithms | **3-1-0** | **4** |
| **6** | Computer Networks | **3-1-0** | **4** |
| **7** | Database Management Systems | **3-1-0** | **4** |
| **8** | Object oriented programming | **3-1-0** | **4** |
| **9** | Data warehousing and Data mining | **3-1-0** | **4** |

**MINOR courses for SPECIALIZED TRACKS**

**Note** 1. **A student can opt Four subjects from any one of the specialized track @ 4 credits per subject**

1. **Concerned BoS can add or delete the subjects as per the decision of the board.**
2. **Pre requisites to be defined by the board for each course.**
3. **Compulsory MOOC/NPTEL Courses for 04 credits (02 courses@ 2 credits each)**
4. **Students need to select the courses which were not offered in their regular programme.**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **S.NO.** | **COURSE NAME** | **L-T-P** | **CR** | **PRE-REQ.** | | **OFFERED TO** |
| **TRACK-1 NETWORKING & SECURITY** | | | | | | |
| 1 | TCP/IP Protocol Suite | 3-1-0 | 4 | |  | CSE/IT |
| 2 | Network Architecture and Design | 3-1-0 | 4 | |  | CSE/IT |
| 3 | Network Security | 3-1-0 | 4 | |  | CSE/IT |
| 4 | Cryptography | 3-1-0 | 4 | |  | CSE/IT |
| 5 | Computer Forensics | 3-1-0 | 4 | |  | CSE/IT |
| 6 | ethical hacking | 3-1-0 | 4 | |  |  |
| **TRACK-2 SOFTWARE ENGINEERING** | | | | | | |
| 1 | Software Metrics and Measurements | 3-1-0 | 4 |  | | CSE/IT |
| 2 | Software Verification and Validation | 3-1-0 | 4 |  | | CSE/IT |
| 3 | Software Architecture and Design Patterns | 3-1-0 | 4 |  | | CSE/IT |
| 4 | Software Project Management | 3-1-0 | 4 |  | | CSE/IT |
| 5 | Fault Tolerant Computing | 3-1-0 | 4 |  | | CSE/IT |
| 6 | Software Testing Methodologies | 3-1-0 | 4 |  | |  |
| **TRACK-3 DISTRIBUTED & CLOUD COMPUTING** | | | | | | |
| 1 | Enterprise Storage Systems | 3-1-0 | 4 |  | | CSE/IT |
| 2 | Parallel Algorithms | 3-1-0 | 4 |  | | CSE/IT |
| 3 | Cloud Networking | 3-1-0 | 4 |  | | CSE/IT |
| 4 | Cloud Computing | 3-1-0 | 4 |  | | CSE/IT |
| 5 | High Performance Computing | 3-1-0 | 4 |  | | CSE/IT |
| 6 | Advanced Computer Architecture | 3-1-0 | 4 |  | |  |
| **TRACK-4 COMPUTATIONAL INTELLIGENCE** | | | | | | |
| 1 | Artificial intelligence | 3-1-0 | 4 |  | | CSE/IT |
| 2 | Machine Learning | 3-1-0 | 4 |  | | CSE/IT |
| 3 | Natural Language Processing | 3-1-0 | 4 |  | | CSE/IT |
| 4 | Neural Networks | 3-1-0 | 4 |  | | CSE/IT |
| 5 | Multi Agent Systems | 3-1-0 | 4 |  | | CSE/IT |
| 6 | Deep Learning | 3-1-0 | 4 |  | |  |

**MOOCs- SWAYAM/NPTEL Minor Course list for 04 credits (02 courses@ 2 credits each)**

**(Tentative- list can be appended)**

**Note: Students need to select the courses which were not offered in their regular programme and minor tracks**

**LIST (ONLY 8 WEEKS)**

|  |  |  |  |
| --- | --- | --- | --- |
| **S.NO** | **COURSE NAME** | **UG-Core/Elective** | **Type of Course** |
| 1. | Programming in C++ | Core | Rerun |
| 2. | Data Base Management System | Core | Rerun |
| 3. | Machine Learning, ML | Elective | Rerun |
| 4. | Programming, Data Structures And Algorithms Using Python | Elective | Rerun |
| 5. | Design and analysis of algorithms | Elective | Rerun |
| 6. | Advanced Computer Architecture | Elective | Rerun |
| 7. | Advanced Graph Theory | Core/Elective | Rerun |
| 8. | Cloud Computing and Distributed Systems | Core/Elective | Rerun |
| 9. | Introduction to Soft Computing | Elective | Rerun |
| 10. | Cloud computing | Elective | Rerun |
| 11. | Data Mining | Elective | Rerun |

**Socially Relevant Projects (15 Hrs)**

1. Water C/onservation Related Works
2. Swatch Bharath (Internal External)
3. Helping police
4. Traffic monitoring
5. Teaching Rural Kids (Sarva siksha Abhiyan)
6. Street light monitoring
7. Electricity Conservation
8. Solar panel utilization
9. E- policing & cyber solution
10. Pollution
11. Smart city
12. COVID awareness
13. Road Safety
14. Any suggested service project from APSCHE list