**Course Name: Advance Computational Science.**

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**Course objective:**

1. **Knowledge:**
2. To gain a deep knowledge of the scientific method and computational science at an advanced level.
3. To understand the possibilities and limits of computational modeling.
4. **Skills:**

To develop a practical mastery of computing, including the interplay between scientific problems and data, mathematical models, generic algorithms and reusable software.

1. **General competence:**

#### To develop a fundamental understanding and knowledge of scientific work and the scientific method, including ethical and societal limitations and possibilities.

#### Full Course Structure:

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| --- | --- | --- | --- | --- | --- |
| Sl No. | Subject | Theory | Time(Hours) | Practical | Time(Hours) |
| 1 | Basic Computer Networking | **Introduction to Networking**  Overview,Objective, Networking Connectivity,Network Topologies, Protocol Layering Concepts, OSI Model and its application. | 6 | Identification of various networks components  - connections, BNC, RJ-45, I/O box  - Cables, Co-axial, twisted pair, UTP  - NIC (network interface card)  - Switch, hub.  Sketch wiring diagrams of network cabling considering a computer lab of 20 systems.  Interfacing with the network card (Ethernet).  Preparing of network cables.  Establishment of a LAN  Design a network. | 8 |
| 2 | **Wireless Sensor Protocols & Programming** | Fundamentals of sensor networks | 6 | Basics of WSN programming using TinyOS | 4 |
| Communication characteristics and deployment mechanisms | 6 | Sensing data using WSN motes. | 4 |
| Routing in wireless sensor networks | 6 | Simulating WSNs made up of motes running TinyOS using the TinyOS simulation framework TOSSIM | 4 |
| Middleware and security issues of Wireless Sensors | 9 | Sensing audio data and interpreting results. | 2 |
|  |  | A project on WSN | 10 |
| 3 | **Cloud architecture and**  **Computing** | Cloud architecture basics | 6 | Implementation of Para-Virtualization using VM Ware‘s  Workstation/ Oracle‘s Virtual Box | 6 |
| End to end design | 6 | A project using VM ware, AWS or Microsoft Azure |
| Cloud application architectures | 6 | 10 |
| Specialized cloud architecture | 9 |
| 4 | **IoT architecture and protocols** | Architectural overview of IoT | 6 | Interoperability in IoT, Introduction to Arduino Programming | 6 |
| The IoT Reference Architecture and Real world design Constraints | 6 | Introduction to Python programming | 8 |
| Big Data analytics for IoT | 9 | Implementation of IoT with Raspberry Pi | 8 |
| Privacy and security in IoT | 9 | A complete IoT based project using Arduino and Raspberry Pi. | 12 |
| Sensing and actuator devices in IoT | 9 |  | |
| 5 | **Fog Computing** | Introduction to fog computing | 4 | Different IoT applications using fog computing | 10 |
| Architecture of fog computing | 4 |
| Fog protocols | 6 |
| 6 | **Project** | ---------------------------------------- | ------ | ----------------------------------- | 35 |
|  |  |  | 113 |  | 127 |