Sr. No.	Semester	Name of Course	Teaching Scheme	Duration	Instructor	Organizing Institute	Credits
Major Specialization: IoT						
	Electrical Engineering						
	SWAYAM/ NPTEL Course List						
1	V	Introduction to Embedded System Design	4hrs/week	12 Weeks	Prof. Dhananjay V. Gadre and Prof. Badri Subudhi	Netaji Subhas University of Technology and IIT Jammu	4
2	V	Introduction to Internet of Things	4hrs/week	12 Weeks	Prof. Sudip Misra	IIT Kharagpur	4
3	VI	Introduction to Industry 4.0 and Industrial Internet of Things	4hrs/week	12 Weeks	Prof. Sudip Misra	IIT Kharagpur	4
4	VI	Wireless Ad- Hoc and Sensor Networks	4hrs/week	8 Weeks	Prof. Sudip Misra	IIT Kharagpur	4
5	VII	Cloud Computing	4hrs/week	8 Weeks	Prof. Soumya Kanti Ghosh	IIT Kharagpur	4

NPTEL courses for Honors
Course Contents
1. Introduction to Embedded System Design
Number of Weeks: 12

Week 1: Introduction to Embedded Systems and Computer Systems Terminology. Modular approach to Embedded System Design using Six-Box model: Input devices, output devices, embedded computer, communication block, host and storage elements and power supply.

Week 2: Microcontroller Based Embedded System Design. Salient Features of Modern Microcontrollers. Elements of Microcontroller Ecosystem and their significance.

Week 3: Design of Power Supply for Embedded Systems. Linear Regulator Topologies. Switching Power Supply Topologies. Power Supply Design Considerations for Embedded Systems.

Week 4: Introduction to MSP430 Microcontroller. MSP430 CPU Architecture. Programming Methods for MSP430. Introduction to Lunchbox Platform.

Week 5: Fundamentals of Physical Interfacing. Connecting Input Devices:Switches, Keyboard and Output devices: LEDs, Seven Segment Displays(SSD). Assignment: MCQ/MSQ.

Week 6: Advanced Physical Interfacing: Driving load - high side, low side and H-bridge. Multiplexing displays including Charlieplexing. Shaft encoder.

Week 7: Programming the MSP430. Basics of version control system - Git. Installing and using Code Composer Studio(CCS). Introduction to Embedded C. Interfacing LEDs and Switches with MSP430 using Digital Input and Output.

Week 8: MSP430 Clock and Reset System. MSP430 Clock sources and distribution. Types of Reset sources. Handling Interrupts in MSP430. Writing efficient Interrupt Service Routine (ISR).

Week 9: Interfacing Seven Segment Displays and Liquid Crystal Displays with MSP430. Low Power Modes in MSP430. Introduction to MSP430 Timer Module and it's Modes of Operation.

Week 10: Generating Pulse Width Modulation (PWM) using Timer Capture Mode. ADC operation in MSP430. Interfacing analog inputs. Generating random numbers using LFSR and other methods. Adding DAC to MSP430. Custom Waveform generation using MSP430.

Week 11: Timer Capture Modes. Measuring frequency and time period of external signals and events. Serial Communication Protocols: UART, SPI, I2C. Interfacing Universal Serial Communication Interface (USCI) Module of the MSP430 for UART Communication. Advanced Coding. Exercises based on Interrupt driven Programming. Building an Electronics Project.

Week 12: Circuit Prototyping techniques. Designing Single Purpose Computers using Finite State Machine with Datapath (FSMD) approach. MSP430 Based Project Design and Implementation. Recap of Course Coverage.

2. Introduction to Internet of Things

Number of Weeks: 12

Week 1:   Introduction to IoT: Part I, Part II, Sensing, Actuation, Basics of Networking: Part-I.

Week 2:   Basics of Networking: Part-II, Part III, Part IV, Communication Protocols: Part I, Part II.

Week 3:   Communication Protocols: Part III, Part IV, Part V, Sensor Networks: Part I, Part II.

Week 4:   Sensor Networks: Part III, Part IV, Part V, Part VI, Machine-to-Machine Communications.

Week 5:   Interoperability in IoT, Introduction to Arduino Programming: Part I, Part II, Integration of Sensors and Actuators with Arduino: Part I, Part II.

Week 6:   Introduction to Python programming, Introduction to Raspberry Pi, Implementation of IoT with Raspberry Pi.

Week 7:   Implementation of IoT with Raspberry Pi (contd), Introduction to SDN, SDN for IoT.

Week 8:   SDN for IoT (contd), Data Handling and Analytics, Cloud Computing.

Week 9:   Cloud Computing(contd), Sensor-Cloud.

Week 10:   Fog Computing, Smart Cities and Smart Homes.

Week 11:   Connected Vehicles, Smart Grid, Industrial IoT.

Week 12:   Industrial IoT (contd), Case Study: Agriculture, Healthcare, Activity Monitoring.

3. Introduction to Industry4.0 and Industrial Internet of Things

Number of Weeks: 12

Week 1: Introduction: Sensing & actuation, Communication-Part I, Part II, Networking-Part I, Part II.

Week 2: Industry 4.0: Globalization and Emerging Issues, The Fourth Revolution, LEAN Production Systems, Smart and Connected Business Perspective, Smart Factories.

Week 3: Industry 4.0: Cyber Physical Systems and Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Augmented Reality and Virtual Reality, Artical Intelligence, Big Data and Advanced Analysis.

Week 4: Cybersecurity in Industry 4.0, Basics of Industrial IoT: Industrial Processes-Part I, Part II, Industrial Sensing & Actuation, Industrial Internet Systems.

Week 5: IIoT-Introduction, Industrial IoT: Business Model and Referece Architerture: IIoT-Business Models-Part I, Part II,

Week 6: IIoT Reference Architecture-Part I, Part II. Industrial IoT- Layers: IIoT Sensing-Part I, Part II, IIoT Processing-Part I, Part II, IIoT Communication-Part I.

Week 7: Industrial IoT- Layers: IIoT Communication-Part II, Part III, IIoT Networking-Part I, Part II, Part III.

Week 8: Industrial IoT: Big Data Analytics and Software Dened Networks: IIoT Analytics - Introduction, Machine Learning and Data Science - Part I, Part II, R and Julia Programming, Data Management with Hadoop.

Week 9: Industrial IoT: Big Data Analytics and Software Dened Networks: SDN in IIoT-Part I, Part II, Data Center Networks, Industrial IoT: Security and Fog Computing: Cloud Computing in IIoT-Part I, Part II.

Week 10: Industrial IoT: Security and Fog Computing - Fog Computing in IIoT, Security in IIoT-Part I, Part II, Industrial IoT- Application Domains: Factories and Assembly Line, Food Industry.

Week 11: Industrial IoT- Application Domains: Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications), Facility Management.

Week 12: Industrial IoT- Application Domains: Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries, Case studies. Self-Referential Structures and Introduction to Lists; Advanced Topics.

4. Wireless and Ad Hoc and Sensor Networks
Number of Weeks: 08

Week 1:   MANET (Introduction, Self-organizing behaviour, Co-operation).

Week 2:   MANET (MAC, Routing).

Week 3:   MANET (Multicasting routing, Mobility model, Transport layer), Opportunistic Mobile Networks.

Week 4:   Opportunistic Mobile Networks, UAV networks, Wireless Sensor Networks (Introduction).

Week 5:   WSN (Coverage, Topology management), Mobile Sensor Networks.

Week 6:   WSN (MAC, Congestion control, Routing).

Week 7:   WSN (Routing), Underwater WSN.

Week 8:   Security, Structure of sensor nodes.

5. Cloud Computing

Number of Weeks: 8

Week 1:   Introduction to Cloud Computing.

Week 2:   Cloud Computing Architecture.

Week 3:   Service Management in Cloud Computing.

Week 4:   Data Management in Cloud Computing.

Week 5:   Resource Management in Cloud.

Week 6:   Cloud Security.

Week 7:   Open Source and Commercial Clouds, Cloud Simulator.

Week 8:   Research trend in Cloud Computing, Fog Computing.