Major Specialization: IOT					
Electronics and Telecommunication Engineering / Electronics / Electronics and Communication Sandwich and Biomedical Engineering					
SWAYAM/NPTEL Course List					
Sr. No.	Sem	Name of Course	Teaching Scheme	Duration	Instructor	Organizing Institute
1	V	Introduction to Embedded System Design	4hrs/ week	12 Weeks	Prof. Dhananjay V. Gadre Prof. Badri Subudhi	Netaji Subhas University of Technology and IIT Jammu
2	V	Introduction to internet of things	4hrs/ week	12 Weeks	Prof. Sudip Misra	IIT KGP
3	VI	Introduction to Industry 4.0 and Industrial Internet of Things	4hrs/ week	12 Weeks	Prof. Sudip Misra	IIT KGP
4	VI	Wireless Ad Hoc and Sensor Networks	4hrs/ week	8 Weeks	Prof. Sudip Misra	IIT KGP
5	VII	Cloud computing	4hrs/ week	8 Weeks	Prof. Soumya Kanti Ghosh	IIT KGP

Note:

1) Minimum 8 to 12 week course is required to allot 4 credits for the course.
2) Structure should be uniform, across all branches.

Syllabus

1. **Introduction to Embedded System Design**

Week	Contents
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 its 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 Data path (FSMD) approach. MSP430 Based Project Design and Implementation. Recap of Course Coverage.

2.   Introduction to internet of things

Week	Contents
Week 1	Introduction to IoT, Sensing, Actuation, Basics of Networking
Week 2	Basics of Networking, Communication Protocols
Week 3	Communication Protocols, Sensor Networks.
Week 4	Sensor Networks, Machine-to-Machine Communications
Week 5	Interoperability in IoT, Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino.
Week 6	Introduction to Python programming, Introduction to Raspberry
Week 7	Implementation of IoT with Raspberry Pi, Introduction to SDN.
Week 8	SDN for IoT, Data Handling and Analytics, Cloud Computing.
Week 9	Cloud Computing, Sensor-Cloud
Week 10	Fog Computing, Smart Cities and Smart Homes.

Week 11	Connected Vehicles, Smart Grid, Industrial IoT.
Week 12	Industrial IoT, Case Study: Agriculture, Healthcare, Activity Monitoring.

3. Introduction to Industry 4.0 and Industrial Internet of Things

Week	Contents
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, Artificial Intelligence, Big Data and Advanced Analysis
Week 4	Cyber security 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 Reference Architecture: IIoT-Business Models-Part I, Part II, IIoT Reference Architecture-Part I, Part II
Week 6	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, and 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 Ad Hoc and Sensor Networks

Week	Contents
Week 1	MANET (Introduction, Self-organizing behavior, Co-operation
Week 2	MANET (MAC, Routing)
Week 3	MANET (Multicast 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

Week	Contents
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