

Computer Engineering / Information Technology
Course List for Major Degree
Track: Internet of Things
MOOCS Platform: NPTEL/SWAYAM

Sr N o	Course Name	Teaching Scheme	Duration (Weeks)	Credit s	Institute Offering Course	Name of Professor/ Resource Person
1	Introduction to the Internet of Things	4Hrs /week	12 Weeks	4	IIT KGP	Prof. Sudip Misra
2	Introduction to Industry 4.0 and Industrial Internet of Things	4Hrs /week	12 Weeks	4	IIT KGP	Prof. Sudip Misra
3	Cloud Computing	4Hrs /week	8 Weeks	4	IIT KGP	Prof. Soumya Kanti Ghosh
4	Introduction to Blockchain Technology and Applications	4Hrs /week	8 Weeks	4	IIT Kanpur	Prof. Sandeep Shukla
5	Google Cloud Computing Foundations	4Hrs /week	8 Weeks	4	IIT KGP & Google	Prof. Soumya Kanti Ghosh

Course 1: Introduction to the Internet of Things

Module 1:

Lecture 1: Introduction to IoT- Part-I
Lecture 2: Introduction to IoT- Part-II
Lecture 3: Sensing
Lecture 4: Actuation
Lecture 5: Basics of IoT Networking- Part- I

Module 2:

Lecture 6: Basics of IoT Networking-Part II
Lecture 7: Basics of IoT Networking-Part-III
Lecture 8: Basics of IoT Networking- Part-IV
Lecture 9: Connectivity Technologies- Part-I
Lecture 10: Connectivity Technologies- Part-II

Module 3:

Lecture 11: Connectivity Technologies- Part-III
Lecture 12: Connectivity Technologies- Part- IV
Lecture 13: Connectivity Technologies- Part- V
Lecture 14: Sensor Networks- Part- I
Lecture 15: Sensor Networks- Part- II

Module 4:

Lecture 16: Sensor Networks- Part-III
Lecture 17: Sensor Networks- Part-IV
Lecture 18: Sensor Networks- Part-V
Lecture 19: UAV Networks
Lecture 20: Machine to Machine Communication

Module 5:

Lecture 21: Interoperability in Internet of Things
Lecture 22: Introduction to Arduino- I
Lecture 23: Introduction to Arduino- II
Lecture 24: Integration of Sensors and Actuators with Arduino- I
Lecture 25: Integration of Sensors and Actuators with Arduino- II

Module 6:

Lecture 26: Introduction to Python Programming- I
Lecture 27: Introduction to Python Programming- II
Lecture 28: Introduction to Raspberry Pi- I
Lecture 29: Introduction to Raspberry Pi- II
Lecture 30: Implementation of IoT with Raspberry Pi- I

Module 7:

Lecture 31: Implementation of IoT with Raspberry Pi- II
Lecture 32: Implementation of IoT with Raspberry Pi- III
Lecture 33: Software Defined Networking- Part-I
Lecture 34: Software Defined Networking- Part-II
Lecture 35: Software Defined IoT Networking- Part- I

Module 8:

Lecture 36: Software Defined IoT Networking- II
Lecture 37: Cloud Computing-Fundamental
Lecture 38: Cloud Computing-Service Model

Lecture 39: Cloud Computing-Service Management and Security

Lecture 40: Cloud Computing- Case Studies

Module 9:

Lecture 41: Cloud Computing- Practical

Lecture 42: Sensor-Cloud- I

Lecture 43: Sensor-Cloud- II

Lecture 44: Fog Computing- I

Lecture 45: Fog Computing- II

Module 10:

Lecture 46: Smart Cities and Smart Homes- I

Lecture 47: Smart Cities and Smart Homes- II

Lecture 48: Smart Cities and Smart Homes- III

Lecture 49: Connected Vehicles- I

Lecture 50: Connected Vehicles- II

Module 11:

Lecture 51: Smart Grid- I

Lecture 52: Smart Grid- II

Lecture 53: Industrial Internet of Things- I

Lecture 54: Industrial Internet of Things- II

Lecture 55: Data Handling and Analytics- I

Module 12:

Lecture 56: Data Handling and Analytics- II

Lecture 57: Case Study: Agriculture

Lecture 58: Case Study: Healthcare

Lecture 59: Case Study: Activity Monitoring - I

Lecture 60: Case Study: Activity Monitoring - II

Course 2: Introduction to Industry 4.0 and Industrial Internet of Things

Module 1:

- Lecture 1: Introduction: Sensing & Actuation
- Lecture 2: Introduction: IoT Connectivity Part 1
- Lecture 3: Introduction: IoT Connectivity Part 2
- Lecture 4: Introduction: IoT Networking Part 1
- Lecture 5: Introduction: IoT Networking Part 2

Module 2:

- Lecture 06: Industry 4.0: The Fourth Revolution
- Lecture 07: Industry 4.0: Sustainability Assessment of Manufacturing Industry
- Lecture 08: Industry 4.0: Lean Production System
- Lecture 09: Industry 4.0: Smart and Connected Business Perspective
- Lecture 10: Industry 4.0: Smart Factories

Module 3:

- Lecture 11: Industry 4.0: Cyber-Physical Systems and Next-Generation Sensors
- Lecture 12: Industry 4.0: Collaboration Platform and Product Lifecycle Management
- Lecture 13: Industry 4.0: Augmented Reality and Virtual Reality
- Lecture 14: Industry 4.0: Artificial Intelligence
- Lecture 15: Industry 4.0: Big Data and Advanced Analysis

Module 4:

- Lecture 16: Industry 4.0: Cybersecurity
- Lecture 17: Basics of Industrial IoT: Introduction
- Lecture 18: Basics of Industrial IoT: Industrial Internet Systems
- Lecture 19: Basics of IIoT: Industrial Sensing & Actuation
- Lecture 20: Basics of Industrial IoT: Industrial Processes Part 1

Module 5:

- Lecture 21: Basics of Industrial IoT: Industrial Processes Part 2
- Lecture 22: Business Models and Reference Architecture for IIoT: Business Models Part 1
- Lecture 23: Business Models and Reference Architecture for IIoT: Business Models Part 2
- Lecture 24: Business Models and Reference Architecture for IIoT: Reference Architecture Part 1
- Lecture 25: Business Models and Reference Architecture for IIoT: Reference Architecture Part 2

Module 6:

- Lecture 26: Key Enablers of Industrial IoT: Sensing-Part 1
- Lecture 27: Key Enablers of Industrial IoT: Sensing-Part 2
- Lecture 28: Key Enablers of Industrial IoT: Connectivity-Part 1
- Lecture 29: Key Enablers of Industrial IoT: Connectivity-Part 2
- Lecture 30: Key Enablers of Industrial IoT: Connectivity-Part 3

Module 7:

- Lecture 31: Key Enablers of Industrial IoT: Connectivity Part 4
- Lecture 32: Key Enablers of Industrial IoT: Connectivity Part 5
- Lecture 33: Key Enablers of Industrial IoT: Processing Part 1
- Lecture 34: Key Enablers of Industrial IoT: Processing Part 2
- Lecture 35: Key Enablers of Industrial IoT: Process Control

Module 8:

- Lecture 36: IIoT Analytics and Data Management: Introduction
- Lecture 37: IIoT Analytics and Data Management: Machine Learning and Data Science Part 1
- Lecture 38: IIoT Analytics and Data Management: Machine Learning and Data Science Part 2
- Lecture 39: IIoT Analytics and Data Management: Cloud Computing in IIoT Part 1

Lecture 40: IIoT Analytics and Data Management: Cloud Computing in IIoT Part 2

Module 9:

Lecture 41: Analytics and Data Management: Fog Computing in IIoT

Lecture 42: IIoT Analytics and Data Management: Tutorial for R & Julia Programming

Lecture 43: IIoT Analytics and Data Management: Data Management with Hadoop

Lecture 44: IIoT Analytics and Data Management: Data Center Networks

Lecture 45: Advanced Technologies: Software-Defined Networking (SDN) in IIoT Part 1

Module 10:

Lecture 46: Advanced Technologies: Software-Defined Networking (SDN) in IIoT Part 2

Lecture 47: Advanced Technologies: Security in IIoT Part 1

Lecture 48: Advanced Technologies: Security in IIoT Part 2

Lecture 49: IIoT Applications: Factories and Assembly Line

Lecture 50: IIoT Applications: Food Industry

Module 11:

Lecture 51: IIoT Applications: Inventory Management & Quality Control

Lecture 52: IIoT Applications: Plant Security and Safety

Lecture 53: IIoT Applications: Facility Management

Lecture 54: IIoT Applications: Oil, Chemical and Pharmaceutical Industry

Lecture 55: IIoT Applications: UAVs in Industries

Module 12:

Lecture 56: IIoT Applications: Oil, Chemical and Pharmaceutical Industry

Lecture 57: IIoT Applications: UAVs in Industries

Lecture 58: Case Studies for Industry 4.0 & IIoT

Lecture 59 : Milk Processing and Packaging Industries

Lecture 60: Manufacturing Industries - Part I

Lecture 61: Manufacturing Industries - Part II

Lecture 62: Student Projects - Part I

Lecture 63: Student Projects - Part II

Lecture 64: Virtual Reality Lab

Lecture 65: Steel Technology Lab

Course 3: Cloud Computing

Module 1: Introduction to Cloud Computing

Module 2: Cloud Computing Architecture

Module 3: Service Management in Cloud Computing

Module 4: Data Management in Cloud Computing

Module 5: Resource Management in Cloud

SLA-Tutorial

Cloudeconomics-Tutorial

MapReduce-Tutorial

ResourceMgmt-I

ResourceMgmt-II

Module 6: Cloud Security

Cloud Computing: Security I

Cloud Computing: Security II

Cloud Computing: Security III

Cloud Computing: Security Issues in Collaborative SaaS Cloud

Cloud Computing: Broker for Cloud Marketplace

Module 7: Open Source and Commercial Clouds, Cloud Simulator

Mobile Cloud Computing -I

Mobile Cloud Computing -II

Fog Computing-I

Fog Computing-II

Use Case-Geo-spatial Cloud

Module 8: Research trend in Cloud Computing, Fog Computing

Introduction to DOCKER Container

Green Cloud

Sensor Cloud Computing

IoT Cloud

Course Summary and Research Areas

Course 4: Introduction to Blockchain Technology and Applications

Module 1: Introduction – basic ideas behind blockchain, how it is changing the landscape of digitalization, introduction to cryptographic concepts required

Module 2: Hashing, public key cryptosystems, private vs public blockchain and use cases, Hash Puzzles,
Introduction to Bitcoin Blockchain

Module 3: Bitcoin Blockchain and scripts, Use cases of Bitcoin Blockchain scripting language in micropayment, escrow etc Downside of Bitcoin – mining .

Module 4: Alternative coins – Ethereum and Smart contracts

Module 5: Alternative coins – Ethereum continued, IOTA

Module 6: The real need for mining – consensus – Byzantine Generals Problem, and Consensus as a distributed coordination problem – Coming to private or permissioned blockchains – Introduction to Hyperledger

Module 7: Permissioned Blockchain and use cases – Hyperledger, Corda

Module 8: Uses of Blockchain in E-Governance, Land Registration, Medical Information Systems, and others.

Course 5: Google Cloud Computing Foundations

Module 1: What's the cloud anyway? Start with a solid platform

Introduction to Cloud
Cloud Computing
Cloud vs Traditional Architecture
IaaS, PaaS and SaaS
Google Cloud Architecture
Cloud Computing Recap Quiz
Summary - Cloud Computing
Introduction - Start with a Solid Platform
The GCP Console
Understanding Projects
Billing in GCP
Install and Configure Cloud SDK
Use Cloud Shell [With Labs]
GCP APIs
Cloud Console Mobile App
Recap Quiz - Start with a Solid Foundation

Module 2: Use GCP to build your apps

Introduction
Compute Options in the Cloud
Exploring IaaS with Compute Engine [With Lab]
Configuring Elastic Apps with Autoscaling
Exploring PaaS with App Engine [With Lab]
Event Driven Programs with Cloud Functions [With Lab]
Containerizing and Orchestrating Apps with GKE
Summary

Module 3: Introduction

Storage Options in the Cloud
Structured and Unstructured Storage in the Cloud
Unstructured Storage using Cloud Storage [With Lab]
SQL Managed Services
Exploring Cloud SQL [With Lab]
Cloud Spanner as a Managed Service
NoSQL Managed Services Options
Cloud Datastore a NoSQL Document Store [With Lab]
Cloud Bigtable as a NoSQL Option
Summary

Module 4: There's an API for that! You can't secure the Cloud right?

Introduction to API
The Purpose of APIs
Cloud Endpoints [With Lab]
Using Apigee
Managed Message Services
Cloud Pub/Sub [With Lab]
Recap Quiz - There's an API for that!
Introduction - Cloud Security
Introduction to security in the cloud
Understanding the shared security model
Explore encryption options
Understand authentication and authorization [With Lab]

Identify best practices for authorization
Recap Quiz - Security
Summary – Security

Module 5: It helps to Network

Introduction
Intro to Networking in the Cloud
Defining a Virtual Private Cloud
Public and Private IP Address Basics
Googles Network Architecture
Routes and Firewall Rules in the Cloud [With Lab]

Module 6: It helps to Network (continued)

Multiple VPC Networks [With Lab]
Building Hybrid Clouds
Different Options for Load Balancing [With Labs]
Recap Quiz
Summary

Module 7: Let Google keep an eye on things. You have the data, but what are you doing with it

Introduction - Let Google keep an eye on things
Introduction to IaC
Cloud Deployment Manager
Monitoring and Managing Your Services, Apps, and Infra
Stackdriver [With Lab]
Recap Quiz - Let Google keep an eye on things
Summary - Let Google keep an eye on things
Introduction - You have the data, but what are you doing with it?
Intro to Big Data Managed Services in the Cloud
Leverage Big Data Operations with Cloud Dataproc [With Labs]
Build ETL Pipelines using Cloud Dataflow [With Labs]
BigQuery Googles Enterprise Data Warehouse
Recap Quiz - You have the data, but what are you doing with it?
Summary - You have the data, but what are you doing with it?

Module 8: Let machines do the work

Introduction
Introduction to ML
ML and GCP
Building Bespoke ML models
Cloud AutoML [With Lab]
Googles Pre-trained ML APIs [With Labs]
Recap Quiz
Summary