Dr. Babasaheb Ambedkar Technological University
(Established as a University of Technology in the State of Maharashtra)
(Under Maharashtra Act No. XXIX of 2014)
P.O. Lonere, Dist. Raigad, Pin 402 103, Maharashtra
Telephone and Fax. 02140 - 275142
www.dbatu.ac.in

Structure and Detailed Syllabus

for UG Degree

Minor in IoT

in line with New Education Policy 2020

(Effective from Academic year 2024-25 for main campus)

Bucket for Minor in IoT

Case I: B. Tech degree with Minor in IoT (160-176 credits)

The Bachelor's Engineering Degree in chosen Engg./ Tech. Discipline with multidisciplinary minor (min.160-max.176 Credits) i.e. "**B. Tech in chosen Engg./ Tech. Discipline with Minor in IoT**" (160-176 credits) enables students to take up four-six or required additional courses of 14 credits in the discipline other than **chosen Engg./ Tech. Discipline** distributed over semesters III to VIII.

Case II: Bachelor's Engineering Degree in chosen Engg./ Tech. Discipline with Double Minor (Multidisciplinary and Specialization Minor 180-194 credits)

The **Bachelor's Engineering Degree in chosen Engg./ Tech. Discipline with Double Minor** (Multidisciplinary and Specialization Minor, 180-194 credits), i.e. "**B. Tech in chosen Engg./ Tech. Discipline with minor in *other selected discipline in* Engineering (as MDM) with Specialization Minor in IoT**" (180-194 credits) enables students to take up four-six additional courses of 14 credits in the discipline other than **chosen Engg./ Tech. Discipline** (for completion of multidisciplinary minor) and 18 to 20 extra credits in the **IoT** distributed over semesters III to VIII. Here, the ***other selected discipline* in Engineering should be different from Specialization Minor i.e. IoT**. This enables students to take up four-six or required additional courses of 18 to 20 credits in the discipline of **IoT** distributed over semesters III to VIII, which are over and above the min.160-max.176 Credits. The decision regarding the mechanism of distribution of these 18-20 credits over semesters III to VIII, prescribed for the duration of four years will be taken by respective BoS. **Student must have CGPA equal to or greater than 7.5 at the end of second semester to go for this option**.

Basic Semester wise credit distribution of the syllabus is as follows as per NEP-2020.

Semester		I	II	III	IV	V	VI	VII	VIII	Total Credits
Basic Science Course	BSC/ESC	06-08	08-10		--	--	--	--	--	14-18
Engineering Science Course		10-08	06-04		--	--	--	--	--	16-12
Programme Core Course (PCC)	Program Courses	--	02	08-10	08-10	10-12	08-10	04-06	04-06	44-56
Programme Elective Course (PEC)		--	--	--	--	04	08	02	06	20
Multidisciplinary Minor (MD M)	Multidisciplinary Courses		-	02	02	04	02	02	02	14
Open Elective (OE) Other than a particular program		--	--	04	02	02	--	--	--	08
Vocational and Skill Enhancement Course (VSEC)	Skill Courses	02	02	--	02	--	02	--	--	08
Ability Enhancement Course (AEC -01, AEC-02)	Humanities Social Science and Management (HSSM)	02	--	--	02	--	--	--	--	04
Entrepreneurship/Economics/ Management Courses		--		02	02	--	--	--	--	04
Indian Knowledge System (IKS)			02		--	--	--	--	--	02
Value Education Course (VEC)		--	--	02	02	--	--	--	--	04
Research Methodology	Experiential Learning Courses	--	--	--	--	--	--		04	04
Comm. Engg. Project (CEP)/Field Project (FP)		--	--	02	--	--	--	-	-	02
Project		--	--	--	--	--	--		04	04
Internship/ OJT		--	---			--	--	12	-	12
Co-curricular Courses (CC)	Liberal Learning Courses	02	02		--	--	--	--	-	04
Total Credits (Major)		**20-22**	**20-22**	**20-22**	**20-22**	**20-22**	**20-22**	**20-22**	**20-22**	**160-176**

List of Courses for

Minor in IoT

Sr. No.	Course Name	Teaching Scheme	Duration (Weeks)	Credits	Institute Offering Course	Name of Professor/ Resource person	Link
1	Introduction to Embedded System Design	4Hrs /week	12 weeks	3	Netaji Subhas University of Technology, IIT Jammu	Prof. Dhananjay V. Gadre, Prof. Badri Subudhi	https://onlinecourses.nptel.ac.in/noc20_ee98/preview
2	Introduction to Internet of Things	4Hrs /week	12 weeks	3	IIT Kharagpur	Prof. Sudip Misra	https://onlinecourses.nptel.ac.in/noc22_cs53/preview
3	Introduction to Industry 4.0 and Industrial Internet of Things	4Hrs /week	12 weeks	3	IIT Kharagpur	Prof. Sudip Misra	https://onlinecourses.nptel.ac.in/noc20_cs69/preview
4	Wireless Ad Hoc and Sensor Networks	4Hrs /week	8 weeks	2	IIT Kharagpur	Prof. Sudip Misra	https://archive.nptel.ac.in/courses/106/105/106105160/
5	Cloud Computing	4Hrs /week	8 weeks	2	IIT Kharagpur	Prof. Soumya Kanti Ghosh	https://onlinecourses.nptel.ac.in/noc21_cs14/preview
6	Introduction to Blockchain Technology and Applications	4Hrs /week	8 weeks	3	IIT Kanpur	Prof. Sandeep Shukla	https://onlinecourses.nptel.ac.in/noc20_cs01/preview
7	Google Cloud Computing Foundations Course	4Hrs /week	8 weeks	2	IIT Kharagpur, Google Cloud	Prof. Soumya Kanti Ghosh, Multifaculty	https://onlinecourses.nptel.ac.in/noc20_cs55/preview
8	Foundation of Cloud IoT Edge ML	4Hrs /week	8 weeks	2	IIT Patna	Prof. Rajiv Misra	https://onlinecourses.nptel.ac.in/noc24_cs26/preview

Introduction to Embedded System Design

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.

Introduction to Internet of Things

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

Introduction to Industry 4.0 and Industrial Internet of Things

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, Artifical 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, 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 Defined 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 Defined 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, Real case studies :

Case study - I : Milk Processing and Packaging Industries

Case study - II: Manufacturing Industries - Part I

Case study - III : Manufacturing Industries - Part II

Case study - IV : Student Projects - Part I

Case study - V : Student Projects - Part II

Case study - VI : Virtual Reality Lab

Case study - VII : Steel Technology Lab

Wireless Ad Hoc and Sensor Networks

Week 1

- Lecture 1: Introduction: Wireless Ad Hoc Networks- Part- I
- Lecture 2: Introduction: Wireless Ad Hoc Networks- Part- II
- Lecture 3: Self-organizing Behaviour of Wireless Ad Hoc Networks
- Lecture 4: Cooperation in Mobile Ad Hoc Networks- Part- I

Week 2

- Lecture 5: Cooperation in Mobile Ad Hoc Networks- Part- II
- Lecture 6: MAC Protocols in MANETs- Part- I
- Lecture 7: MAC Protocols in MANETs- Part- II
- Lecture 8: Routing in MANETs- Part- I
- Lecture 9: Routing in MANETs- Part- II
- Lecture 10: Routing in MANETs- Part- III

Week 3

- Lecture 11: Multicasting in MANETs
- Lecture 12: Mobility Models for MANETs
- Lecture 13: Transport Protocols for MANETs- Part- I
- Lecture 14: Transport Protocols for MANETs- Part- II
- Lecture 15: Opportunistic Mobile Networks- Part- I

Week 4

- Lecture 16: Opportunistic Mobile Networks- Part- II
- Lecture 17: Opportunistic Mobile Networks- Part- III
- Lecture 18: UAV Networks- Part- I
- Lecture 19: UAV Networks- Part- II
- Lecture 20: UAV Networks- Part- III

Week 5

- Lecture 21: Introducation: Wireless Sensor Networks- Part- I
- Lecture 22: Introducation: Wireless Sensor Networks- Part- II
- Lecture 23: WSN Coverage & Placement- Part-I
- Lecture 24: Topology Mangement in Wireless Sensor Network
- Lecture 25: Mobile Wireless Sensor Networks

Week 6

- Lecture 26: Mobile Wireless Sensor Networks
- Lecture 27: Medium Access Control in Wireless Networks- Part-I
- Lecture 28: Medium Access Control in Wireless Networks- Part-II
- Lecture 29: Routing in Wireless Sensor Networks- Part- I
- Lecture 30: Routing in Wireless Sensor Networks- Part- II

Week 7

- Lecture 31: Congestion and Flow Control- Part- I
- Lecture 32: Congestion and Flow Control- Part- II
- Lecture 33: Underwater Sensor Networks- Part- I
- Lecture 34: Underwater Sensor Networks- Part- II
- Lecture 35: Underwater Sensor Networks- Part- III

Week 8

- Lecture 36 : Underwater Sensor Networks- Part- IV
- Lecture 37 : Security of Wireless Sensor Networks- Part- I
- Lecture 38 : Security of Wireless Sensor Networks- Part- II
- Lecture 39 : Hardware Design of Sensor Node
- Lecture 40 : Real Life Deployment of WSN

Cloud Computing

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

Introduction to Blockchain Technology and Applications

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

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

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

Week 4 : Alternative coins – Ethereum and Smart contracts

Week 5 : Alternative coins – Ethereum continued, IOTA

Week 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

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

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

Google Cloud Computing Foundations Course

Week 0 : Introduction to the course

Week 1 : So, What's the Cloud anyway? Start with a Solid Platform

Week 2 : Use GCP to build your Apps

Week 3 : Where do I store this stuff?

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

Week 5 : It helps to network!

Week 6 : It helps to network (continued)

Week 7 : Let Google keep an eye on things.

You have the data, but what are you doing with it?

Week 8 : Let machines do the work

Foundation of Cloud IoT Edge ML

Week 1: Introduction to Cloud and its limitations to support low latency use cases

Week 2: Edge Computing to support IoT applications such as self driving cars, etc

Week 3: Introduction to IoT Edge platforms such as Azure IoT hub, AWS IoT platform

Week 4: Introduction to docker container and kubernetes in edge computing

Week 5: Concepts of distributed systems in IoT applications such as time ordering and clock synchronisation, distributed snapshot, etc

Week 6: Edge Design of IoT storage system like key value store

Week 7: Introduction to MQTT and Kafka for end-to-end IoT pipeline

Week 8: Use Cases of Machine Learning for IOT in predictive maintenance, image classifier, and self-driving cars