

## M.Tech. (CSE with Specialization in Internet of Things (CSE-IoT)

### Programme Structure July 2021 onwards

#### FIRST SEMESTER

SNo	Course		Contact Hours				Credits
	No.	Title	L	T	P	Total	
1.	17M11CS111	Data Structures and Algorithms for Big Data	3	-	-	03	3
2.	17M11CS112	Machine Learning and Data Mining	3	-	-	03	3
3.	21xxxxx	Elective – I	3	-	-	03	3
4.	21xxxxx	Elective – II	3	-	-	03	3
5.	21xxxxx	Elective – III	3	-	-	03	3
6.	18M11GE111	Research Methodology and Intellectual Property Right	2	-	-	02	2
7.	17M15CS111	Advanced Algorithms Lab	-	-	2	02	1
8.	17M15CS112	Machine Learning and Data Mining Lab			2	02	1
9.	17M15CS113	Cloud Technology Lab			2	02	1
		TOTAL	17	-	6	23	20

#### Elective-I

- A. Data Science using Python
- B. Advances in Artificial Intelligence

#### Elective –II

- A. Smart Sensing for IoT
- B. Wireless Sensor Networks and IoT

#### Elective-III

- A. Principles of Sensors & Signal Processing
- B. IoT Applications Engineering

#### SECOND SEMESTER

SNo	Course		Contact Hours				Credits
	No.	Title	L	T	P	Total	
1.	17M11CS121	Cloud and Web Services Software Engineering	3	-	-	03	3
2.	17M11CS122	Performance Evaluation of Computing Systems	3	-	-	03	3
3.	21xxxxx	Elective – IV - Bucket	3	-	-	03	3
4.	21xxxxx	Elective – V	3	-	-	03	3
5.		Audit-I ( HSS)	2	-	-	02	Qualifying
6.	17M17CS111	Project Based Learning-I (Open Source Software Development )		-	4	04	2
7.	17M15CS121	Cloud and Web Services Lab	-	-	2	02	1
8.	17M15CS122	Performance Engineering Lab			2	02	1
9.	17M15CS123	IOT Systems Development Lab			2	02	1
		TOTAL	15	-	10	24	17

**Elective-IV**

- A. IoT Data Analytics
- B. IoT Security and Trust

**Elective-V**

- A. Industrial IoT
- B. Intelligent Internet of Things

**THIRD SEMESTER**

SNo	Course		Contact Hours				Credits
	No.	Title	L	T	P	Total	
1.		OPEN ELECTIVE	3			3	3
2.	17M17CS212	Seminar & Term Paper/ Supervised Study or credits transfer from another university through normal course or MOOC				4	4
3.	17M17CS211	Project Based Learning-II (Software Development Automation)				8	4
4.	17M17CS213/ 17M17CS214/ 17M17CS215	Dissertation /Industrial Project/Entrepreneurial Project				8	4
5.		Audit-II (HSS)	2			2	Qualifying
		<b>TOTAL</b>					15

**FOURTH SEMESTER**

SNo	Course		Contact Hours				Credits
	No.	Title	L	T	P	Total	
1.	17M17CS223/ 17M17CS224/ 17M17CS225	Dissertation /Industrial Project/ Entrepreneurial Project				32	16
		<b>TOTAL</b>					16

**TOTAL CREDITS : 68****Course outline for Electives****Elective-I****A. Data Science using Python:**

Python Fundamentals; Data Preparation: Data cleaning, Handling Missing Data, Aggregation; Inferential Statistics, Various forms of distribution: A normal distribution, normal distribution from a binomial distribution, A Poisson distribution, The chi-square distribution; Exploratory Data Analysis: Analysing univariate and multivariate data: Heat Map, Box and Whisker plot, Scatter plots with histograms, Bubble charts.; Model development: Creating training and testing sets, Building a model, Model evaluation, Evaluating a model based on test data, Model building and evaluation with SciKit; Supervised learning: Decision trees, Linear regression: Simple and Multiple and Logistic regression, Naive Bayes classifier. ; Unsupervised learning: The k-means clustering, Hierarchical clustering;

## **B. Advances in Artificial Intelligence:**

Introduction to Artificial Intelligence, Overview of probability theory, Bayes networks, Independence, I-Maps, Undirected graphical models, Bayesian and Markov networks, Local models; Exact inference, Clique trees, Belief propagation, Tree construction, Introduction to optimization, Approximate inference: sampling, Markov chains, MAP inference, Inference in temporal models; Learning graphical models, parameter estimation, Bayesian networks and shared parameters, structure learning, Partially observed data, Gradient descent, Expected Maximization, Hidden variables, Undirected models, Undirected structure learning, Causality, Utility functions, Decision problem, Expected utility.

## **Elective-II**

### **A. Smart Sensing for IoT:**

Data Acquisition, Sensors, Different Types of Sensors, Characteristics of Sensors, Fractional order element, Impedance Spectroscopy, Architecture of Smart Sensors, Fabrication of Sensor and Smart Sensor, Interface Electronic Circuit for Smart Sensors and Challenges for Interfacing the Smart Sensor, Wireless sensor network (WSN) and Internet of Things (IoT), Smart Sensors Networks Applications.

### **B. Wireless Sensor Networks and IoT:**

Wireless communication Protocols, Characteristic and challenges, WSN vs Ad-hoc Networks, Sensor node architecture, Physical layer and transceiver design considerations in WSNs, Energy usage profile. Taxonomy of routing techniques in sensor networks, MAC protocols for sensor network, Localization in WSN, Application layer protocols, Localization protocols, Positioning and location tracking in WSN. Coverage and Connectivity: Computation and networking problems, Coverage algo, Connectivity Algo, Information Retrieval in SN, Sensor Fusion. Fundamental of Internet of Things, IoT reference Architecture. Methods to integrate WSNs into the Internet.

## **Elective-III**

### **A. Principles of Sensors & Signal Processing:**

Sensor fundamentals and characteristics, Sensor Signal Conditioning: Optical Sources and Detectors , Intensity Polarization and Interferometric Sensors, Strain, Force, Torque and Pressure sensors, Position, Direction, Displacement and Level Sensors, Velocity and Acceleration sensors , Flow, Temperature and Acoustic sensors.

### **B. IoT Applications Engineering**

Introduction to Markup language- HTML document structure, Style (CSS), Multiple CSS stylesheets, DHTML, Tools for image creation and manipulation, User experience design, IoT development using charts; Introduction to JavaScript- Functions, Forms, and Event Handlers, Object Handlers, input validation, J2ME, application design using J2ME, IoT development using Real time rules, platforms, alerts; Mobile app development for IoT- Android Development environment, Simple UI Layouts and layout properties, GUI objects, Event Driven Programming. IIoT Fundamentals and Components, Industrial Manufacturing, Monitoring, Control, Optimization and Autonomy, Introduction to Hadoop and big data analytics; Use Cases: Wearable devices for remote monitoring of Physiological parameter, ECG, EEG, Diabetes and Blood Pressure.

## Elective-IV

### A. IoT Data Analytics

Introduction to data analytics for IoT – Structured Versus Unstructured Data – Data in Motion Versus Data at Rest – IoT analytics overview and challenges ;Machine learning and Deep learning for getting Intelligence from IoT Big Data – IoT Predictive Analytics ;Geographical Concepts and Spatial Technology for IoT; Big data Platform for IoT Analytics Massively parallel processing databases - Hadoop Ecosystem, Lambda Architecture- NoSQL Databases – Cloud based Amazon web services, Azure Data Lake and IoT Hub, Node RED; Edge and Fog Computing –Architecture of Edge and Fog Computing - Edge Analytics Core Functions – Distributed Analytics Systems - Fog Computing -Big Data Metadata Management – Data lifecycle - Data analytics at different Fog Layers ; Flexible NetFlow Architecture – FNF components – Flexible NetFlow in Multiservice IoT Networks - IoT Network Analytics; Web enhanced IoT -Design layers, design complexity- Web Enhanced Building Automation Systems – Smart City Control and Monitoring – Smart Environment Monitoring

### B. IoT Security and Trust

Security Requirements in IoT Architecture ,Security in Enabling Technologies , Security Concerns in IoT Applications, Security Architecture in the Internet of Things, Security Requirements in IoT, Attacks Specific to IoT. Vulnerabilities , Secrecy and Secret-Key Capacity, Authentication/Authorization for Smart Devices ,Transport Encryption, Attack & Fault trees. Identity & access management solutions for IOT, Identity lifecycle ,authentication credentials, IoT IAM infrastructure, Authorization with Publish / Subscribe schemes , access control, Capability-based access control schemes, Concepts, identity-based and identity-driven, Light weight cryptography, need and methods . Securing internet of things environment, Secured Protocols for IOT, IoT Hardware, Secure from Physical Attacks, IoT Software -Trusted IOT Application Platforms, Secure Firmware Updating, Network Enforced Policy, Secure Analytics, Visibility and Control. Privacy preservation and trust models for IOT, Concerns in data dissemination, Lightweight and robust schemes for Privacy protection, Trust and Trust models for IOT, self-organizing Things, Preventing unauthorized access.

## Elective-V

### A. Industrial IoT

Understanding Industrial Internet of Things (IIoT), Industrial Automation, IIoT Sensors and Devices, IIoT Networks and Protocols, Security and Privacy in IIoT, Design and Development of IIoT systems, Industry 4.0: Smart Factory, IIoT Project based on real industry use case and Internship.

### B. Intelligent Internet of Things

Smart Cities as the Prototype of the Intelligent Internet of Things- Smart Inventory Control -Smart Delivery -Smart Marketing Using Artificial Intelligence - Smart Residences -A City of Smart Connected Homes- Wearable Electronics-Control Electronics -Smart Individual Transportation - Overview of Smart Automobiles - Driving Aids - Engine Processors - Auto Body Processors Infotainment Processors - Autonomous Cars -Smart Transportation Networks -Smart Public Conveyance Networks - Individual Automotive Traffic Control- Smart Highways -Smart Energy Networks- Smart Electrical Meters-Smart Electrical Grids - Smart Connected Buildings -Smart Office Buildings- Smart Factories- Intelligent Hospitals -Smart Public Buildings; Additionally, through different The Smart “Things” in IoT, cyber physical systems, Internet of Everything; Emerging Hardware Technologies for IoT Data Processing.