

Syllabus
Honour Programme in
Internet of Things
(Programme commenced from AY 2024-25)
(Department of Electronics and Computer Engineering)

From
Academic Year 2024-25
(SVU-KJSCE 2.0)

(Approved by BOS dated _____, FOET dated _____,
and AC dated _____, Item No. _____)

Honour Programme in the Internet of Things

Offered by the Department of Electronics and Computer Engineering

Introduction

The Fourth Industrial Revolution, or Industry 4.0, brings digital and physical technologies together to create responsive, interconnected operations. From the supply chain to the smart factory, enterprises are using AI, robotics, edge computing, and the cloud to make informed, timely decisions. Solutions designed for the Industrial Internet of Things (IIoT) use connected sensors and edge devices to help improve product quality and factory operational efficiency in real-time.

Objective

- Understand the various market segments and the potential revenue opportunities in each market segment
- Plan for and develop a solid security approach to keep advisories from hacking an IIoT system
- Staff a project and then plan and execute a product schedule
- What Industry 4.0 is and what factors have enabled the IIoT.

Learning Outcomes:

At the successful completion of this minor program an engineering graduates will be able to

LO1: Understand the basic concepts of IoT and smart factory

LO2: Develop industrial applications using PLC, SCADA

Eligibility Criteria :

The candidate should have completed Basic Electrical & Electronics Engineering course along with Basics of Electronics Circuits course.

Assessment Methods: Tests, Mini projects, Laboratory, Presentation/ Video making ,Quiz, study of research papers etc.

Honours Programme in Internet of Things

Teaching and Credit Scheme

Course Code	Course Name	Teaching Scheme (Hrs.) TH – P – TUT	Total (Hrs.)	Credits Assigned TH – P – TUT	Total Credits	Semester of Major Degree
216H06C401	Cloud computing	3 – 0 – 0	03	3 – 0 – 0	03	IV
216H06L401	Cloud computing Laboratory	0 – 2 – 0	02	0 – 1 – 0	01	IV
216H06C501	Design And Development of IoT systems	3 – 0 – 0	03	3 – 0 – 0	03	V
216H06L501	Design And Development of IoT Systems Laboratory	0 – 2 – 0	02	0 – 1 – 0	01	V
216H06C601	Sensor Data Mining And Analytics	3 – 0 – 0	03	3 – 0 – 0	03	VI
216H06L601	Sensor Data Mining And Analytics Laboratory	0 – 2 – 0	02	0 – 1 – 0	01	VI
216H07L602	Industrial Automation: PLC and SCADA Laboratory	0 – 4 – 0	04	0 – 2 – 0	02	VI
216H06C701	Industrial IOT Security	3 – 0 – 0	03	3 – 0 – 0	03	VII
216H07L701	Industrial IOT Security Laboratory	0 – 2 – 0	02	0 – 1 – 0	01	VII
Total		12– 12 – 0	24	12 – 06 – 0	18	

Evaluation Scheme

Course Code	Course Name	Examination Scheme				
		Marks				
		CA		ESE	LAB/T UT CA	Total
		ISE	IA			
216H06C401	Cloud computing	30	20	50	-	100
216H06L401	Cloud computing Laboratory	-	-	-	50	50
216H06C501	Design And Development of IoT systems	30	20	50	-	100
216H06L501	Design And Development of IoT Systems Laboratory	-	-	-	50	50
216H06C601	Sensor Data Mining And Analytics	30	20	50	-	100
216H06L601	Sensor Data Mining And Analytics Laboratory	-	-	-	50	50
216H07L602	Industrial Automation: PLC and SCADA Laboratory	-	-	-	50	50
216H06C701	Industrial IOT Security	30	20	50	-	100
216H07L701	Industrial IOT Security Laboratory	-	-	-	50	50
Total		120	80	200	250	650

Course Code	Course Title				
216H06C401	Cloud Computing				
	TH	P	TUT	Total	
Teaching Scheme (Hrs.)	03	--	--	03	
Credits Assigned	03	--	--	03	
Examination Scheme	Marks				
	CA		ESE	LAB/TUT CA	Total
	ISE	IA			
	30	20	50	--	100

Course prerequisites:

Knowledge of Operating Systems

Course Objectives: The objective of this course is to provide graduate students of Information Systems with comprehensive and in-depth knowledge of Cloud Computing concepts, technologies, architecture, and applications by introducing and researching state-of-the-art in Cloud Computing fundamental issues, technologies, applications

Course Outcomes:

At the end of successful completion of the course the student will be able to

- CO1.** Understand the differences between traditional deployment and cloud computing
- CO2.** Determine whether existing applications to the cloud make technical and business sense
- CO3.** Analyze and compare the long-term costs of cloud services
- CO4.** Learn how to build a transactional web application for the cloud or migrate one to it

Module No.	Unit No.	Topics	Hrs.	CO
1	Cloud Architecture Basics		9	CO1
	1.1	Cloud architecture standards and interoperability- Cloud types		
	1.2	Benefits and challenges of cloud computing, public, private clouds community cloud, the role of virtualization in enabling the cloud.		
2	End-to-end Architecture		9	CO2

	2.1	Requirement analysis: strategic alignment and architecture development cycle.		
	2.2	Strategic impact and risk analysis, technical criteria		
	2.3	Cloud opportunities evaluation criteria and weight-end to end system content delivery networks		
	2.4	Capacity planning, security architecture.		
3	Cloud application architectures		9	CO3
	3.1	Development environments for service development		
	3.2	Amazon, Azure, and Google App cloud platforms in the industry.		
4	Application into the cloud		9	CO2
	4.1	Web Application Design, privacy design		
	4.2	Database Management for clouds		
5	Specialized cloud architecture		9	CO4
	5.1	Workload distribution architecture		
	5.2	Dynamic scalability		
Total			45	

Recommended Books:

Sr. No.	Name/s of Author/s	Title of Book	Name of Publisher with Country	Edition with Year of Publication
1.	Reese, G	<i>Cloud Application Architectures: Building Applications and Infrastructure in the Cloud</i>	Sebastopol, CA: O'Reilly Media, Inc. (2009).	1 st edition 2009
2.	John Rhoton	<i>Cloud Computing Explained: Handbook for Enterprise Implementation</i>	Recursive Limited	2nd ed. edition 2009
3.	M N Rao	<i>Cloud Computing</i>	Prentice Hall Pub, India	1 st edition 2015
4.	J Hurwitz	<i>Cloud Computing for Dummies</i>	Wiley Publications	1 st edition, 2010

Course Code	Course Title				
216H06L401	Cloud Computing Laboratory				
	TH	P	TUT	Total	
Teaching Scheme(Hrs.)	0	2	0	2	
Credits Assigned	0	1	0	1	
Examination Scheme	Marks				
	CA		ESE	LAB/TUT CA	Total
	ISE	IA			
	-	-		50	50

Term-Work:

Term work will consist of experiments/ tutorials covering the entire syllabus of the course '216H06C401'. Students will be graded based on continuous assessment of their term work.

Course Code	Course Title				
216H06C501	Design And Development of IoT systems				
	TH	P	TUT	Total	
Teaching Scheme (Hrs.)	03	--	--	03	
Credits Assigned	03	--	--	03	
Examination Scheme	Marks				
	CA		ESE	LAB/TUT CA	Total
	ISE	IA			
	30	20	50	--	100

Course prerequisites:

Microprocessor and application
Knowledge of Python / C-programming

Course Objectives: Learn to create the next generation of IoT-enabling technologies, by designing an IoT system to connect embedded sensors using commodity smartphones via low-power Bluetooth Low Energy. Skills such as app development and embedded system design are practiced using various applications including a sensor station.

Course Outcomes:

At the end of successful completion of the course the student will be able to

- CO1:** System Design knowledge of the Internet of Things.
- CO2:** Understanding the design architecture of IoT.
- CO3:** Choice of protocols and deployment in solutions
- CO4:** Overview and Design Perspective of IoT-based products /services.
- CO5:** Understanding IIoT design with the help of case studies

Module No.	Unit No.	Topics	Hrs.	CO
1	Introduction to Internet of Things		9	CO1
	1.1	Introduction to IoT, Components of IoT		
	1.2	Key terms – IoT Platform, Interfaces, API, clouds, Data Management Analytics, Mining & Manipulation.		
	1.3	Anatomy of the Thing, Industrial Internet of Things		
2	System Design of Connected Devices		9	CO2
	2.1	Internet – Reference Architecture IoT, IoT system components: sensors, Gateways, Routers, Modem, Cloud brokers, servers and its integration, Wireless Sensor Network (WSN)		
	2.2	Physical design of IoT: Things in IoT, IoT protocol. IoT levels & deployment templates		
	2.3	Logical design of IoT: IoT functional blocks, IoT communication models, IoT communication API's		
3	IoT Communication protocols and cloud		9	CO3
	3.1	IoT protocols –COAP, MQTT, 6lowpan, lwm2m, AMPQ, CAN-BUS		
	3.2	IoT cloud platforms: Overview of cost of cloud platforms, predix, thing works, azure etc. Data analytics, cloud services, Business models: Saas, Paas, Iaas, UNIT		
4	Developing of IoT		9	CO4
	4.1	IoT Design methodology: Steps involved in IoT system design and methodology, Process specification, Domain model specification, Information model specification, Service level specification, Functional and operational use specification, Device and component integration and application development.		
	4.2	Quality Assurance, Predictive Maintenance, Real-Time Diagnostics		
5	IoT Applications (Case Study)		9	CO5
	5.1	Home Automation, Smart / Precision Agriculture, Weather Monitoring Station, e-Health Body Area Networks, Connected Car.		

	5.2	Industrial IoT Supply chain management system		
Total			45	

Recommended Books:

Sr. No.	Name/s of Author/s	Title of Book	Name of Publisher with country	Edition and Year of Publication
1.	ArshdeepBahga, Vijay Madiseti	<i>Internet of Things a hands-on approach</i>	Universities Press	1 st 2017
2.	Olivier Hersent, David Boswarthic , Omar Elloumi	<i>The Internet of Things key applications and protocol</i>	Wiley India	2 nd 2017
3.	Adrian McEwen & Hakim cassimally	<i>Designing the internet of things</i>	Wiley India	2 nd 2017
4.	Davis Hanes, Gonzalo, Patrics, Rob, Jerome	<i>IoT fundamentals, Networking technologies, protocols, and case studies.</i>	Ciscopress.com	e-book
5.	Dirk Slama, Frank puhlmann	<i>Enterprise IoT</i>	Shroff Publishers & distributors Pvt. Ltd.	1 st 2015

Course Code	Course Title				
216H06L501	Design And Development of IoT Systems Laboratory				
	TH	P	TUT	Total	
Teaching Scheme(Hrs.)	0	2	0	2	
Credits Assigned	0	1	0	1	
Examination Scheme	Marks				
	CA		ESE	LAB/TUT CA	Total
	ISE	IA			
	-	-	-	50	50

Term-Work:

Term work will consist of experiments/ tutorials covering entire syllabus of the course '216H06C501'. Students will be graded based on continuous assessment of their term work

Course Code	Course Title			
216H06C601	Sensor Data Mining And Analytics			
	TH	P	TUT	Total
Teaching Scheme (Hrs.)	03	--	--	03
Credits Assigned	03	--	--	03
Examination Scheme	Marks			
	CA		ESE	LAB/TUT CA
	ISE	IA		
	30	20		
		50	--	100

Course prerequisites: Programming basics

Course Objectives: This course provides a way to understand the concepts and the basics of big data mining and analytics and their role in the Internet of things

Course Outcomes:

At the end of successful completion of the course the student will be able to

- CO1.** Understand the concept of Big data
- CO2.** Understand data types and data pre-processing
- CO3.** Understand data mining concepts
- CO4.** Understanding data analytic techniques

Module No.	Unit No.	Topics	Hrs.	CO
1	Introduction to BIG data		9	CO1
	1.1	Data warehouse, Independent vs. dependent Data marts, Evolving data management strategies		
	1.2	DBMS schemas for decision support - data extraction, clean-up, and transformation tools- Metadata		
2	Data objects and pre-processing		9	CO2
	2.1	Data objects and Attribute types, Basic statistics of data, data visualization, measuring data similarities and dissimilarities.		

	2.2	Overview of data pre-processing, data cleaning, data integration, data reduction, and data transformation and discretization		
3	Data mining concepts		9	CO2
	3.1	Introduction to data mining. A multidimensional view of data mining. Types of Data Mining Type of Patterns.		
	3.2	Technology used, Applications. Major Issues in Data Mining.		
	3.3	Data warehousing mining and on-line analytical processing: Data cube and OLAP, design and usage and implementation		
4	Data Analytics techniques		9	CO4
	4.1	Regression Analytics, Monte Carlo simulation factor analysis, Cohort analysis, Cluster analysis, Time series analysis, and Sentiment analysis.		
	4.2	Mapreduce: The map tasks, grouping by key, the reduce tasks, combiners, details of mapreduce execution. Algorithm using MapReduce: Matrix-Vector Multiplication by mapreduce, relational-algebra operations, computing selections by mapreduce, computing projections by map reduce,		
5	SUSTAINABILITY DATA AND ANALYTICS		9	CO4
	5.1	Sustainability Data and Analytics in Cloud-Based M2M Systems, Potential stakeholders and their complex relationships to data and analytics applications – Social Networking Analysis.		
	5.2	Building a useful understanding of a social network – Leveraging.		
	5.3	Social Media and IoT to Bootstrap Smart Environments: lightweight Cyber-Physical Social Systems - citizen actuation.		
Total			45	

Recommended Books:

Sr. No.	Name/s of Author/s	Title of Book	Name of Publisher with Country	Edition with Year of Publication
1.	Stackowiak, R., Licht, A., Mantha, V., Nagode, L	<i>Big Data and The Internet of Things Enterprise Information Architecture for A New Age</i>	Springer Nature Apress, India	1 st Edition, 2015
2.	Arshdeep Bahga, Vijay Madisetti	<i>Internet of Things a hands-on approach</i>	Orient Blackswan Private Limited - New Delhi	1 st Edition 2015
3.	Olivier Hersent, David Boswarthic , Omar Elloumi	<i>The Internet of Things key applications and protocol</i>	Wiley India	2 nd Edition, 2017
4.	Adrian McEwen & Hakim Cassimally	<i>Designing the internet of things</i>	Wiley India	2 nd Edition, 2017

Course Code	Course Title				
216H06C601	Sensor Data Mining And Analytics Laboratory				
	TH	P	TUT	Total	
Teaching Scheme(Hrs.)	0	02	--	02	
Credits Assigned	0	01	--	01	
Examination Scheme	Marks				
	CA		ESE	LAB/TUT CA	Total
	ISE	IA			
	-	-	-	50	50

Term-Work:

Term work will consist of experiments/ tutorials covering the entire syllabus of the course '216H06C601'. Students will be graded based on continuous assessment of their term work

Course Code	Course Title				
216H07L602	Industrial Automation: PLC and SCADA Laboratory				
	TH	P	TUT	Total	
Teaching Scheme(Hrs.)	—	2	0	2	
Credits Assigned	—	2	0	2	
Examination Scheme	Marks				
	CA		ESE	LAB CA	Total
	ISE	IA			
	—	—	—	50	50

Term-Work:

Term work will consist of experiments/ tutorials. Students will be graded based on continuous assessment of their term work.

Course Code	Course Title			
216H06C701	Industrial IOT Security			
	TH	P	TUT	Total
Teaching Scheme (Hrs.)	03	--	--	03
Credits Assigned	03	--	--	03
Examination Scheme	Marks			
	CA		ESE	LAB/TUT CA
	ISE	IA		
	30	20	50	--
				100

Course prerequisites: Basic knowledge of IoT and Cloud Computing.

Course Objectives: To learn the security principles and methodologies for the Internet of Things. Be able to secure a connected IoT product from scratch. Be able to discuss the main threats and attacks on IoT products and services. Know how to research and assess IoT threats and risks as they arise. Be able to implement a security reporting scheme in their organization.

Course Outcomes:

At the end of successful completion of the course the student will be able to

- CO1.** Ability to understand the Security requirements in IoT.
- CO2.** Understand the cryptographic fundamentals for IoT
- CO3.** Ability to understand the authentication credentials and access control.
- CO4.** Understand the various types of Trust models and Cloud Security.

Module No.	Unit No.	Topics	Hrs.	CO
1	Introduction		9	CO1
	1.1	Security Requirements in IoT Architecture, Types of Threats, Security Layers in IoT Architecture, Challenges to Secure IoT		
	1.2	Insecure Access Control, Threats to Access Control, Privacy, and Availability. Attacks Specific to IoT. Vulnerabilities – Secrecy and Secret-Key Capacity.		
	1.3	Authentication and Authorization for Smart Devices - Transport Encryption – Attack & Fault Trees.		
2	CRYPTOGRAPHIC FUNDAMENTALS FOR IOT		10	CO2
	2.1	Cryptographic primitives and their role in IoT-Encryption		

		and Decryption, Hashes, Digital Signatures		
	2.2	Random number generation, Cipher suites – key management fundamentals		
	2.3	cryptographic controls built into IoT messaging and communication protocols – IoT Node Authentication.		
3	IDENTITY & ACCESS MANAGEMENT SOLUTIONS FOR IOT		8	CO3
	3.1	Identity lifecycle, authentication credentials		
	3.2	Authorization with Publish / Subscribe schemes – access control		
4	PRIVACY PRESERVATION AND TRUST MODELS FOR IOT		9	CO2
	4.1	Concerns in data dissemination, Lightweight and robust schemes for Privacy protection.		
	4.2	Trust and Trust models for IoT, self-organizing Things - Preventing unauthorized access		
5	CLOUD SECURITY FOR IOT		9	CO4
	5.1	Cloud services and IoT, offerings related to IoT from cloud service providers		
	5.2	IoT security controls, An enterprise IoT cloud security architecture, New directions in cloud-enabled IoT computing.		
Total			45	

Recommended Books:

Sr. No.	Name/s of Author/s	Title of Book	Name of Publisher with Country	Edition with Year of Publication
1.	Brian Russell, Drew Van Duren	<i>Practical Internet of Things Security (Kindle Edition)</i>	Packt Publishing,	2 nd Edition 2018
2.	S. Misra, M. Maheswaran, and S. Hashmi	<i>Security Challenges and Approaches in Internet of Things</i>	Springer International Publishing	1 st Edition 2017
3.	F. Hu.	<i>Security and privacy in Internet of things (IoTs): Models, Algorithms, and Implementations</i>	CRC Press	1 st Edition 2016
4.	S. Li and L. D. Xu.	<i>Securing the Internet of Things</i>	Syngress	2 nd Edition 2017

Course Code	Course Title				
216H06L701	Industrial IOT Security Laboratory				
	TH	P	TUT	Total	
Teaching Scheme(Hrs.)	0	02	--	02	
Credits Assigned	0	01	--	01	
Examination Scheme	Marks				
	CA		ESE	LAB/TUT CA	Total
	ISE	IA			
	-	-	-	50	50

Term-Work:

Term work will consist of experiments/ tutorials covering the entire syllabus of the course '216H06C701'. Students will be graded based on continuous assessment of their term work