Lesson Plan

Branch:TE COMPS

Semester:VI   Year: 2022-2023

Course Title: Internet of Things	SEE: 3 Hours – Theory
Total Contact Hours: 36 Hours	Duration of SEE: 3 Hrs
SEE Marks: 80 (Theory) + 20 (IA)	
Lesson Plan Author: Kranti K.Wagle	Date: 9/01/2023
Checked By:	Date:20/01/2023

Prerequisites:

Prerequisite: C Programming, Digital Logic and Computer Architecture, Microprocessor,Computer Networks.	
Course Objectives:	
1	To equip students with the fundamental knowledge and basic technical competence in the field of Internet of Things (IoT).
2	To emphasize on core IoT functional Stack to build assembly language programs. To learn the Core IoT Functional Stack.
3	To understand the different common application protocols for IoT and apply IoT knowledge to key industries that IoT is revolutionizing.
4	To examines various IoT hardware items and software platforms used in projects for each platform that can be undertaken by a beginner, hobbyist, student, academician, or researcherto develop useful projects or products.

Syllabus:

Module			Content	Hrs
1			**Introduction to Internet of Things (IoT)**	**7**
	1.1		What is IoT? - IoT and Digitization	
	1.2		IoT Impact – Connected Roadways, Connected Factory, Smart ConnectedBuildings, Smart Creatures	
	1.3		Convergence of IT and OT, IoT Challenges	
	1.4		The oneM2M IoT Standardized Architecture	
	1.5		The IoT World Forum (IoTWF) Standardized Architecture	
	1.6		IoT Data Management and Compute Stack – Design considerations and Data related problems, Fog Computing, Edge Computing, The Hierarchy of Edge, Fogand Cloud	
2			**Things in IoT**	**7**
	2.1		Sensors/Transducers – Definition, Principles, Classifications, Types, Characteristics and Specifications	
	2.2		Actuators –- Definition, Principles, Classifications, Types, Characteristics and Specifications	
	2.3		Smart Object – Definition, Characteristics and Trends	
	2.4		Sensor Networks – Architecture of Wireless Sensor Network, Network	

		Topologies	
	2.5	Enabling IoT Technologies - Radio Frequency Identification Technology, Micro-Electro-Mechanical Systems (MEMS), NFC (Near Field Communication), Bluetooth Low Energy (BLE), LTE-A (LTE Advanced), IEEE 802.15.4– Standardization and Alliances, ZigBee.	
3		**The Core IoT Functional Stack**	**6**
	3.1	Layer 1 – Things: Sensors and Actuators Layer	
	3.2	Layer 2 – Communications Network Layer, Access Network Sublayer, Gateways and Backhaul Sublayer, Network Transport Sublayer, IoT Network Management Sublayer	
	3.3	Layer 3 – Applications and Analytics Layer, Analytics Vs. Control Applications,Data Vs. Network Analytics, Data Analytics Vs. Business Benefits, Smart Services	
4		**Application Protocols for IoT**	**7**
	4.1	The Transport Layer	
	4.2	IoT Application Transport Methods	
	4.3	Application Layer Protocol Not Present	
	4.4	SCADA - Background on SCADA, Adapting SCADA for IP, Tunneling Legacy SCADA over IP Networks, SCADA Protocol Translation, SCADA Transport overLLNs with MAP-T,	
	4.5	Generic Web-Based Protocols	
	4.6	IoT Application Layer Protocols – CoAP and MQTT	
5		**Domain Specific IoTs**	**6**
	5.1	Home Automation – Smart Lighting, Smart Appliances, Intrusion Detection,Smoke/Gas Detectors	
	5.2	Cities – Smart Parking, Smart Lighting, Smart Roads, Structural Health Monitoring, Surveillance	
	5.3	Environment – Weather Monitoring, Air Pollution Monitoring, Noise PollutionMonitoring, Forest Fire Detection, River Floods Detection	
	5.4	Energy – Smart Grids, Renewable Energy Systems, Prognostics	
	5.5	Retail – Inventory Management, Smart Payments, Smart Vending Machines	
	5.6	Logistics – Route Generation & Scheduling, Fleet Tracking, Shipment Monitoring	
	5.7	Agriculture – Smart Irrigation, Green House Control	
	5.8	Industry – Machine Diagnostics & Prognosis, Indoor Air Quality Monitoring	
	5.9	Health & Lifestyle – Health & Fitness Monitoring, Wearable Electronics	
6		**Create your own IoT**	**6**

6.1	IoT Hardware - Arduino, Raspberry Pi, ESP32, Cloudbit/Littlebits, ParticlePhoton, Beaglebone Black.	
6.2	IoT Software - languages for programming IoT hardware, for middlewareapplications and API development, for making front ends, REST and JSON-LD	
6.3	A comparison of IoT boards and platforms in terms of computing	
6.4	A comparison of IoT boards and platforms in terms of development environmentsand communication standards	
6.5	A comparison of boards and platforms in terms of connectivity	
6.6	A comparison of IoT software platforms	

Course Outcomes (CO):
On successful completion of course learner will be able to:

CSDLO6011.1   **Explain the architecture of IoT ,Identify and Analyse the Components of IoT.**

CSDLO6011.2   **Emphasize core IoT functional Stack and compare the application protocols for IoT.**

CSDLO6011.3   **Apply IoT knowledge to key industries/domains that IoT is revolutionizing.**

CSDLO6011.4   **Compare the various IoT hardware platforms and software platforms used to implement an IoT system.**

CO-PO Mapping: (BL – Blooms Taxonomy, C – Competency, PI – Performance Indicator)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
CSDLO6011. 1	2	2										
CSDLO6011. 2	2	3										
CSDLO6011. 3	3	3	3	3	2				3	3	2	3
CSDLO6011. 4	3	2	3	3	3				3	3	2	3

CO-PSO Mapping:

CO	BL	C	PI	PO	Mapping

	PSO1	PSO2
CSDLO6011.1		
CSDLO6011.1		
CSDLO6011.1		
CSDLO6011.1		

CO Measurement Weightages for Tools:

	Test	Assignment	BMC	Case Study(Literature Review)	CROSSWORD	SEE (T)	CES
CSDLO6011.1	20%	10%	-	-	10%	60%	100%
CSDLO6011.2	20%			10%	10%	60%	100%
CSDLO6011.3			20%	20%		60%	100%
CSDLO6011.4	20%		10%	10%		60%	100%

Attainment:

CSDLO6011.1

Direct Method

$A_{CSDLO6011.1}= 0.2*Test +0.1*Assignment1+0.1crossword+0.6*SEE\_TheoryFinal$

Final Attainment:

$A_{CSDLO6011.1=}0.8* A_{CSDLO6011.1D}+0.2 A_{CSDLO6011.1I}$

CSDLO6011.2

Direct Method

$A_{CSDLO6011.2}= 0.2*Test +0.1*CaseStudy+0.1crossword+0.6*SEE\_TheoryFinal$

Final Attainment:

$A_{CSDLO6011.2=}0.8* A_{CSDLO6011.2D}+0.2 A_{CSDLO6011.2I}$

CSDLO6011.3

Direct Method

$A_{CSDLO6011.3}= 0.2*test2+0.1BMC+0.1CaseStudy+0.6*SEE\_TheoryFinal$

Final Attainment:

$A_{CSDLO6011.3=}0.8* A_{CSDLO6011.3D}+0.2 A_{CSDLO6011.3I}$

CSDLO6011.4

Direct Method

$A_{CSDLO6011.4}= 0.2*Test +0.1CaseStudy+0.1BMC+0.6*SEE\_TheoryFinal$

Final Attainment:

$A_{CSDLO6011.4=}0.8* A_{CSDLO6011.4D}+0.2 A_{CSDLO6011.4I}$

Course Level Gap (if any):
Content beyond Syllabus: Wireless Sensor Networks (Real Time Example)Guest Lecture planned April 2023

Lecture Plan:

MODU	Contents	Hours	Planned	Actual	Content	Remar

LE			date	date	Delivery Method/Learning Activities	k
1.1	What is IoT? - IoT and Digitization	1	9/1/2023		Blackboard Teaching,PPT	
1.2	IoT Impact – Connected Roadways, Connected Factory, Smart Connected Buildings, Smart Creatures	1	10/1/2023		Blackboard Teaching,PPT	
1.3	Convergence of IT and OT, IoT Challenges	1	13/1/2023		Blackboard Teaching,PPT	
1.4	The oneM2M IoT Standardized Architecture	1	13/1/2023		Blackboard Teaching,PPT	
1.5	The IoT World Forum (IoTWF) Standardized Architecture	1	16/1/2023		Blackboard Teaching,PPT	
1.6	IoT Data Management and Compute Stack – Design considerations and Data related problems, Fog Computing, Edge Computing, The Hierarchy of Edge, Fogand Cloud	1	17/01/2023		Blackboard Teaching,PPT	
2.1	Sensors/Transducers – Definition,Principles, Classifications, Types,	1	20/01/2023		Blackboard Teaching,PPT	Assignment 1
	Characteristics and Specifications	1	23/01/2023		Blackboard Teaching,PPT	
2.2	Actuators -– Definition, Principles, Classifications, Types, Characteristics and specifications.	1	24/01/2023		Blackboard Teaching,PPT	
2.3	Smart Object – Definition, Characteristics and Trends	1	30/01/2023		Blackboard Teaching,PPT	
2.4	Sensor Networks – Architecture of Wireless Sensor Network, Network Topologies	1	1/02/2023		Blackboard Teaching,PPT	
2.5	Enabling IoT Technologies - Radio Frequency Identification Technology, Micro-Electro-Mechanical Systems (MEMS), NFC (Near Field Communication),	1	2/02/2023		Blackboard Teaching,PPT	

	Bluetooth Low Energy (BLE), LTE-A (LTE Advanced), IEEE 802.15.4– Standardization and Alliances, ZigBee.	1	6/02/2023		PPT	Online
3.1	Layer 1 – Things: Sensors and Actuators Layer	1	8/02/2023		Blackboard Teaching,PPT	
3.2	Layer 2 – Communications Network Layer, Access Network Sublayer, Gateways and Backhaul Sublayer, Network Transport Sublayer, IoT Network Management Sublayer	1	8/02/2023		Blackboard Teaching,PPT	
	BMC		9/02/2023		Blackboard Teaching,PPT	
	BMC		13/02/2023		Blackboard Teaching,PPT	
					Blackboard Teaching,PPT	
3.3	Layer 3 – Applications and Analytics Layer, Analytics Vs. Control Applications,Data Vs. Network Analytics, Data Analytics Vs. Business Benefits, Smart Services	1	15/2/2023		Blackboard Teaching,PPT	
4.1	The Transport Layer	1	16/2/2023		Blackboard Teaching,PPT	
4.2	IoT Application Transport Methods	1	20/02/23		Blackboard Teaching,PPT	
4.3	Application Layer Protocol Not Present	1	22/02/23		Blackboard Teaching,PPT	
4.4	SCADA - Background on SCADA, Adapting SCADA for IP, Tunneling Legacy SCADA over IP Networks, SCADA Protocol Translation, SCADA Transport overLLNs with MAP-T,	1	23/01/2023 2/03/2023		Blackboard Teaching,PPT	
4.5	Generic Web-Based Protocols	1	8/03/2023		Blackboard Teaching,PPT	
4.6	IoT Application Layer Protocols –	1	8/03/2023		Blackboard	

	CoAP and MQTT				Teaching,PPT	
5.1	Home Automation – Smart Lighting, Smart Appliances, Intrusion Detection,Smoke/Gas Detectors	1	13/03/2023		CASE STUDY PRESENTATION	
5.2	Cities – Smart Parking, Smart Lighting, Smart Roads, Structural HealthMonitoring, Surveillance	1	15/03/2023		CASE STUDY PRESENTATION	9/03,10/03 Crescendo
	CROSSWORD	1	16/03/2023			
5.3	Environment – Weather Monitoring, Air Pollution Monitoring, Noise Pollution Monitoring, Forest Fire Detection, River Floods Detection	1	16/03/2023		CASE STUDY PRESENTATION	
5.4	Energy – Smart Grids, Renewable Energy Systems, Prognostics	1	20/03/2023		CASE STUDY PRESENTATION	
5.5	Retail – Inventory Management, Smart Payments, Smart Vending Machines	1	23/03/2022		CASE STUDY PRESENTATION	
5.6	Logistics – Route Generation & Scheduling, Fleet Tracking, Shipment Monitoring	1	23/03/2023		CASE STUDY PRESENTATION	22/03 HOLIDAY
5.7	Agriculture – Smart Irrigation, Green House Control	1	27/03/2023		CASE STUDY PRESENTATION	29TH EUPHORIA,30TH HOLIDAY
5.8	Industry – Machine Diagnostics & Prognosis, Indoor Air Quality Monitoring	1	27/03/2023		CASE STUDY PRESENTATION	
5.9	Health & Lifestyle – Health & Fitness Monitoring, Wearable Electronics	1	3/04/2023		CASE STUDY PRESENTATION	
6.0	IoT Hardware - Arduino, Raspberry Pi, ESP32, Cloudbit/Littlebits, ParticlePhoton, Beaglebone Black.	1	3/04/2023		Blackboard Teaching,PPT	
6.1	IoT Software - languages for programming IoT hardware, for	1	5/04/2023		Blackboard Teaching,PP	

	middlewareapplications and API development, for making front ends, REST and JSON-LD				T	
6.2	A comparison of IoT boards and platforms in terms of computing	1	6/04/2023		Blackboard Teaching,PPT	
6.3	A comparison of IoT boards and platforms in terms of development environmentsand communication standards	1	10/04/2023		Blackboard Teaching,PPT	
6.4	A comparison of boards and platforms in terms of connectivity	1	12/04/2023		Blackboard Teaching,PPT	
6.5	A comparison of IoT software platforms	1	13/04/2023		Blackboard Teaching,PPT	
	Revision	1				

Text Books:

1 David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton, Jerome Henry, *"IoT Fundamentals — Networking Technologies, Protocols, and Use Cases for the Internet of Things",* 1st Edition, Published by Pearson Education, Inc, publishing as Cisco Press, 2017.

2 Hakima Chaouchi, *"The Internet of Things - Connecting Objects to the Web",* 1st Edition, Wiley, 2010.

3 Perry Lea, *"Internet of things For Architects",* 1st Edition, Packt Publication, 2018

4 Arshdeep Bahga, Vijay Madisetti, *"Internet of Things — Hands-On Approach",* 2nd Edition, Universities Press, 2016.

Reference Books:

1. Adrian McEwen & Hakim Cassimally, *"Designing the Internet of Things",* 1st Edition,Wiley, 2014.

2. Donald Norris, *"Raspberry Pi — Projects for the Evil Genius",* 2nd Edition, McGraw Hill,2014.

3. Anand Tamboli *,"Build Your Own IoT Platform",* 1" Edition, Apress, 2019.

Evaluation Scheme

CIE Scheme
Internal Assessment: 20 (Average of two tests)

Internal Assessment Scheme

	Module	Lecture Hours	No. of questions in			No. of questions in SEE
			Test 1	Test 2	Test 3*	
1	**Introduction to Internal of Things (IoT)**	6	(5Marks)	-	--	
2	**Things in IoT**	8	(5Marks)	-	--	
3	**The Core IoT Functional Stack**	3	(5Marks)	-	--	
4	**Application Protocols for IoT**	7	(5Marks)	-	--	
5	**Domain Specific IoTs**	9	-	(10Marks)	--	
6	**Create your own IoT**	5	-	(10Marks)	--	

Note: Four to six questions will be set in the Test paper

Verified by:

Programme Coordinator   Subject Expert