Indra Ganesan
COLLEGE OF ENGINEERING

Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai
Accredited by NAAC with 'B+' Grade, 2(f) & 12B Status Institution by UGC
IG Valley, Madurai Main Road, Manikandam, Tiruchirappalli - 620012

NAAC DOCUMENTS

QUALITY INDICATOR FRAME WORK

CRITERION – 1

CURRICULAR ASPECTS

SUBMITTED BY

IQAC

INTERNAL QUALITY ASSURANCE CELL

INDRA GANESAN COLLEGE OF ENGINEERING

Criteria 1	Curricular Aspects	100

1.1 Curricular Planning and Implementation (20)

1.1.1 The Institution ensures effective curriculum planning and delivery through a well-planned and documented process including Academic calendar and conduct of continuous internal Assessment

Table of Content

INDRA GANESAN COLLEGE OF ENGINEERING
IG Valley, Manikandam, Tiruchirappalli, Tamil Nadu – 620 012,
India(ApprovedbyAICTE,NewDelhi,AffiliatedtoAnnaUniversity,Chennai-25)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

PREFACE OF THE COURSE FILE

Batch : 2019-2020

AcademicYear : 2019-2020 /EVEN

Program : M . E . COMPUTER SCIENCE AND ENGINEERING

Year & Semester : 1ST Year / 2ND Semester

Course Code : CP5292 NBA Course Code : C203

Name of the Course : INTERNET OF THINGS

Faculty in-charge : Ms.D.B.Rena

Signature of the Faculty in-charge

HoD/ CSE

Dr. G. Balakrishnan, M.E., Ph.D.,
Principal
Indra Ganesan College of Engineering
IG Valley, Madurai Main Road
Manikandam, Trichy-620 012.

INDRA GANESAN COLLEGE OF ENGINEERING

(Approved by AICTE, New Delhi and affiliated to Anna University, Chennai)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

REVIEW OF COURSE FILE

(to be pasted on the inner side of the file-backside).(#-State Yes/No.)

S.N	Details Date:	R-I-*	R-II-*&	R-III-*&	R-IV-*&$	R-V-*&$@
1.	Preface of the course file	Y				
2.	Vision, Mission, PEOs, POs, PSOs, Blooms taxonomy	Y				
3.	Subject handlers of yesteryears	Y				
4.	Timetable/Workload of the staff – Distribution of teaching load – Roles and Responsibilities	Y				
5.	Syllabus signed by staff & HoD	Y				
6.	Lecture Schedule signed by staff & HoD	Y				
7.	Course Committee meeting circular and minutes	Y				
8.	Identification of Curricular gap and Content Beyond the syllabus	Y				
9.	Self-study topics	Y				
10.	Previous AU Question papers	Y				
11.	Unit wise Q&A and Objective type questions	Y				
12.	Unit wise course material		Y	Y	Y	
13.	Assignment question paper with sample answer sheets and mark entry		Y	Y	Y	
14.	Tutorial question paper with key and mark entry		Y	Y	Y	
15.	Class test/IA test Q Paper with Key, sample answer papers and mark entry		Y	Y	Y	
16.	IA Test- result analysis-CAP-evidence-root cause analysis.		Y	Y	Y	
17.	Retest –Q paper-Attendance-marks		Y	Y	Y	
18.	AU Web portal entry sheet		Y	Y	Y	
19.	Very poor performance in first two tests-action taken.-communication to parents-evidence			Y	Y	
20.	Absence for two tests-action taken-communication to parents-evidence.			Y	Y	
21.	Indiscipline of student reported, if any					
22.	Special class/coaching class/remedial class/attendance-CAP		Y	Y	Y	
23.	Conduct of Seminar, Quizzes - proof					
24.	Content beyond the syllabus - proof					Y
25.	Student feedback on faculty					Y
26.	Course end survey					Y
27.	Internal Assessment sheet					Y
28.	AU question paper with students feedback					Y
29.	Discrepancy of the question paper and correspondence, if any					Y
30.	AU result analysis-Details of arrear students.					Y
31.	AU grade sheet					Y
32.	CO – PO & PSO attainment sheet					Y
	Signature of Course handling faculty					
	Signature of HoD					

INDRAGANESANCOLLEGEOFENGINEERING

IGValley,Manikandam,Tiruchirappalli,TamilNadu–620 012,India(ApprovedbyAICTE, NewDelhi, AffiliatedtoAnnaUniversity, Chennai-25)

DEPARTMENTOFCOMPUTERSCIENCEANDENGINEERING

Faculty TimeTable

DayOrder	1	2	3	4	5	6	7	8
I		IOT						
II					IOT			
III								
IV			IOT					
V						IOT		

S.Code	Title	Year/ Branch	Hours
CP5292	Internet of Things	2019-20	4
TOTAL-4hours			

Dr. G. Balakrishnan, M.E., Ph.D.,
Principal
Indra Ganesan College of Engineering
IG Valley, Madurai Main Road
Manikandam, Trichy-620 012.

CP5292 INTERNET OF THINGS

L T P C
3 0 0 3

OBJECTIVES:

- To understand the fundamentals of Internet of Things
- To learn about the basics of IOT protocols
- To build a small low cost embedded system using Raspberry Pi.
- To apply the concept of Internet of Things in the real world scenario.

UNIT I INTRODUCTION TO IoT 9

Internet of Things - Physical Design- Logical Design- IoT Enabling Technologies - IoT Levels & Deployment Templates - Domain Specific IoTs - IoT and M2M - IoT System Management with NETCONF-YANG- IoT Platforms Design Methodology

UNIT II IoT ARCHITECTURE 9

M2M high-level ETSI architecture - IETF architecture for IoT - OGC architecture - IoT reference model - Domain model - information model - functional model - communication model - IoT reference architecture

UNIT III IoT PROTOCOLS 9

Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Unified Data Standards – Protocols – IEEE 802.15.4 – BACNet Protocol – Modbus–Zigbee Architecture – Network layer – 6LowPAN - CoAP - Security

UNIT IV BUILDING IoT WITH RASPBERRY PI & ARDUINO 9

Building IOT with RASPERRY PI- IoT Systems - Logical Design using Python – IoT Physical Devices & Endpoints - IoT Device -Building blocks -Raspberry Pi -Board - Linux on Raspberry Pi -Raspberry Pi Interfaces - Programming Raspberry Pi with Python - Other IoT Platforms - Arduino.

UNIT V CASE STUDIES AND REAL-WORLD APPLICATIONS 9

Real world design constraints - Applications - Asset management, Industrial automation, smart grid, Commercial building automation, Smart cities - participatory sensing - Data Analytics for IoT – Software & Management Tools for IoT Cloud Storage Models & Communication APIs - Cloud for IoT - Amazon Web Services for IoT.

TOTAL : 45 PERIODS

OUTCOMES:

Upon completion of this course, the students should be able to:

- Analyze various protocols for IoT
- Develop web services to access/control IoT devices.
- Design a portable IoT using Rasperry Pi
- Deploy an IoT application and connect to the cloud.
- Analyze applications of IoT in real time scenario

REFERENCES:

1. Arshdeep Bahga, Vijay Madisetti, —Internet of Things – A hands-on approachl, Universities Press, 2015
2. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), —Architecting the Internet of Thingsl, Springer, 2011.
3. Honbo Zhou, —The Internet of Things in the Cloud: A Middleware Perspectivel, CRC Press, 2012.
4. Jan Ho" ller, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.
5. Olivier Hersent, David Boswarthick, Omar Elloumi , —The Internet of Things – Key Applications and Protocols, Wiley-2012

Dr. G. Balakrishnan, M.E., Ph.D.,
Principal
Indra Ganesan College of Engineering
IG Valley, Madurai Main Road
Manikandam, Trichy-620 012.

INDRA GANESAN COLLEGE OF ENGINEERING

IG Valley, Manikandam, Tiruchirappalli, Tamil Nadu – 620 012, India
(Approved by AICTE, New Delhi, Affiliated to Anna University, Chennai-25)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Lecture Schedule

Degree/Program: **M.E / CSE**
Duration: **EVEN**

Course code &Name: **CP5292**
Semester: **II** Section: Faculty:

AIM:

To understand the fundamentals of Internet of Things

OBJECTIVES:

To understand the fundamentals of Internet of Things

- To learn about the basics of IOT protocols
- To build a small low cost embedded system using Raspberry Pi.
- To apply the concept of Internet of Things in the real world scenario

PREREQUISITES: NIL

COURSE OUTCOMES:

After the course, the student should be able to:

CO	Course Outcomes	POs	PSOs
C213.1	Analyze various protocols for IoT	1,2,3,4	1,2
C213.2	Develop web services to access/control IoT devices	1,2,3,4	1,2
C213.3	Design a portable IoT using Rasperry Pi	1,2,3,4	1,2
C213.4	Deploy an IoT application and connect to the cloud	1,2,3,4	1,2
C213.5	Analyze applications of IoT in real time scenario	1,2,3,4	1,2

S.No	Date	Period	Topics to be Covered	Book & Page. No.
UNIT 1 - INTRODUCTION TO IoT			**Target periods :9**	
1	6.1.20	2	Internet of Things -	
2	7.1.20	5	Physical Design	
3	8.1.20	3	Logical Design	
4	9.1.20	6	IoT Enabling Technologies -	
5	20.1.20	2	IoT Levels & Deployment Templates	
6	21.1.20	5	Domain Specific IoTs	
7	23.1.20	3	IoT and M2M	
8	24.1.20	6	ioT System Management with NETCONF-YANG	
9	27.1.20	2	IoT Platforms Design Methodology	
UNIT II - IoT ARCHITECTURE			**Target periods :9**	
10	28.1.20	5	IoT and M2M	
11	30.1.20	3	IETF architecture for IoT	
13	31.1.20	6	OGC architecture -	
14	3.2.20	2	IoT reference model -	
15	4.2.20	5	Domain model - information model -	

Dr. G. Balakrishnan, M.E., Ph.D.,
Principal
Indra Ganesan College of Engineering
IG Valley, Madurai Main Road
Manikandam, Trichy-620 012.

16	6.2.20	3	functional model	
17	7.2.20	6	communication mode	
18	10.2.20	2	IoT reference architecture	

UNIT III - IoT PROTOCOLS

Target Periods :9

19	11.2.20	5	Protocol Standardization for IoT	
20	13.2.20	3	Efforts – M2M and WSN Protocols –	
21	14.2.20	6	SCADA and RFID Protocols –	
22	17.2.20	2	Unified Data Standards	
23	18.2020	5	Protocols – IEEE 802.15.4 –	
24	20.2.20	3	BACNet Protocol – Modbus– Zigbee Architecture	
25	21.2.20	6	Network layer – 6LowPAN - CoAP - Security	

UNIT IV - BUILDING IoT WITH RASPBERRY PI & ARDUINO

Target Periods :9

26	9.3.20	2	Building IOT with RASPERRY PI	
27	10.3.20	5	IoT Systems	
28	12.3.20	3	Logical Design using Python	
29	13.3.20	6	IoT Physical Devices & Endpoints	
30	23.3.20	2	IoT Device -Building blocks	
31	24.3.20	5	Raspberry Pi -Board -	
32	26.3.20	3	Linux on Raspberry Pi -	
33	27.3.20	6	Raspberry Pi Interfaces -	
34	30.3.20	2	Programming Raspberry Pi with Python - Other IoT Platforms - Arduino	
		5		

UNIT V - CASE STUDIES AND REAL-WORLD APPLICATIONS

Target Periods:9

35	2.4.20	5	Real world design constraints - Applications -	
36	3.4.20	3	Asset management, Industrial automation,	
37	6.4.20	6	smart grid,	
38	7.4.20	2	Commercial building automation	
39	9.4.20	5	Smart cities - participatory sensing	
40	10.4.20	3	Data Analytics for IoT – Software & Management Tools for IoT Cloud Storage Models	
41	20.4.20	6	Communication APIs -	
42	21.4.20	2	Cloud for IoT -	
43	23.4.20	5	Amazon Web Services for IoT.	
44	24.4.20	3	REVISION	
45	27.4.20	6	REVISION	

Dr. G. Balakrishnan, M.E., Ph.D.,
Principal
Indra Ganesan College of Engineering
IG Valley, Madurai Main Road
Manikandam, Trichy-620 012.

Book Reference - Text Books

Sl.	Title of the Book	Author	Publisher	Year
1	"From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence",	Jan Ho" ller, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle,	Elsevier	2014
2	—The Internet of Things – Key applications and Protocols	Olivier Hersent, David Boswarthick, Omar Elloumi , —	Wiley,	2012
3	Internet of Things – A hands-on approachl,	Arshdeep Bahga, Vijay Madisetti,	Universities Press,	2015
4	Architecting the Internet of Thingsl,	Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds),	Springer,	2011.
5	The Internet of Things in the Cloud: A Middleware Perspectivel	Honbo Zhou	CRC Press,	2012.

Website References
http://nptel.iitm.ac.in/courses.php?branch=Compute
www.freebooks,ot.com

Signature of the Faculty in-charge

HoD / CSE

Dr. G. Balakrishnan, M.E., Ph.D.,
Principal
Indra Ganesan College of Engineering
IG Valley, Madurai Main Road
Manikandam, Trichy-620 012.

INDRA GANESAN COLLEGE OF ENGINEERING

IG Valley, Manikandam, Tiruchirappalli, Tamil Nadu – 620 012, India
(Approved by AICTE, New Delhi, Affiliated to Anna University, Chennai-25)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Identification of Curricular Gap & Content Beyond Syllabus(CBS)

Name of the Faculty : DB RENA
Degree & Program: M.E/CSE
Academic Year: 2019 -2020 /EVEN

Course Code & Name: CP5292 INTERNET OF THINGS
Semester & Section: I .ME/A

I.Mapping of Course Outcomes with POs & PSOs.(before CBS)

Table.1 Mapping of COs, C, PSOs with POs - before CBS.

Course	PO1	PO2	PO3	PO4	PO5	PO6
C201.1	3	3	2	2	-	-
C202.2	3	3	2	2	1	-
C202.3	3	3	2	2	1	-
C203.4	3	3	2	2	-	-
C204.5	3	3	2	2	1	-
C205.6	3	3	2	2	1	-

II. Identification of content beyond syllabus.

Table.2 Identification of content beyond syllabus

Details of Content Beyond Syllabus(CBS) added	POs strengthened/ vacant filled	CO/Unit
Embedded computing logic, Microcontroller, System on Chips	PO5(1) Vacant filled	C201.1/ I

III. Mapping of Course Outcomes with POs & PSOs. (After CBS)

Table.3 Mapping of COs, C, PSOs with POs- after CBS.

Course	PO1	PO2	PO3	PO4	PO5	PO6
C201.1	3	3	2	2	1	-
C202.2	3	3	2	2	1	-
C202.3	3	3	2	2	1	-
C203.4	3	3	2	2	-	-
C204.5	3	3	2	2	1	-
C205.6	3	3	2	2	1	-

Signature of the Faculty

HoD/CSE

Dr. G. Balakrishnan, M.E., Ph.D.,
Principal
Indra Ganesan College of Engineering
IG Valley, Madurai Main Road
Manikandam, Trichy-620 012.

INDRA GANESAN COLLEGE OF ENGINEERING

IG Valley, Manikandam, Tiruchirappalli, Tamil Nadu – 620 012, India
(Approved by AICTE, New Delhi, Affiliated to Anna University, Chennai-25)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Proof of Content Beyond Syllabus

Name of the Faculty : DB RENA **Course Code & Name: CP5292 INTERNET OF THINGS**
Degree & Program: M.E/CSE **Semester & Section: II / A**
Academic Year: 2019 -2020 /EVEN

TOPIC: Embedded computing logic, Microcontroller, System on Chips

Arduino Device:

Arduino devices are the microcontrollers and microcontroller kit for building digital devices that can be sense and control objects in the physical and digital world. Arduino boards are furnished with a set of digital and analog input/output pins that may be interfaced to various other circuits. Some Arduino boards include USB (Universal Serial Bus) used for loading programs from the personal computer.

Intel Galileo:

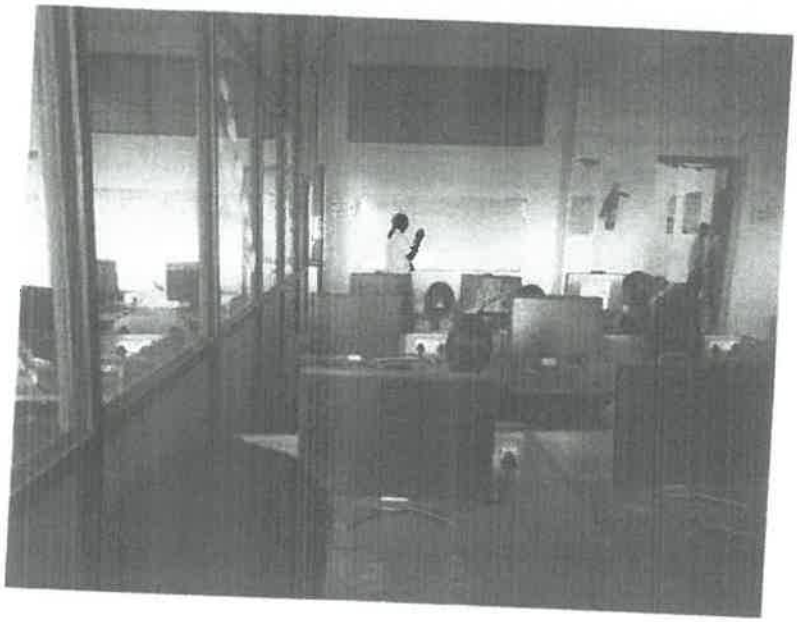
The Intel Galileo Gen 2 Board includes the parts such as Intel Quark SoC processor, 256MB RAM, multiple ports and supports for Arduino device.

Bluetooth Low Energy (BLE) Intelligent Beacon:

A Bluetooth low energy beacon device is used to track the object located at a real time. Many companies use it to track the location of employees, assets, patients, and more in real time. This service primarily focuses on manufacturing, retail, and healthcare services.

- **Sense:** The devices that sense its surrounding environment in the form of temperature, movement, and appearance of things, etc.
- **Send and receive data:** IoT devices are able to send and receive the data over the network connection.
- **Analyze:** The devices can able to analyze the data that received from the other device over the internet networks.
- **Controlled:** IoT devices may control from some endpoint also. Otherwise, the IoT devices are themselves communicate with each other endlessly leads to the system failure.

Dr. G. Balakrishnan, M.E., [illegible]
Principal
Indra Ganesan College of Engineering
IG Valley, Madurai Main Road
Manikandam, Trichy-620 012.



IoT Devices

Signature of the Faculty

HoD/CSE

Dr. G. Balakrishnan, M.E., Ph.D.,
Principal
Indra Ganesan College of Engineering
IG Valley, Madurai Main Road
Manikandam, Trichy-620 012.

INDRA GANESAN COLLEGE OF ENGINEERING

IG Valley, Manikandam, Tiruchirappalli, Tamil Nadu – 620 012, India
(Approved by AICTE, New Delhi, Affiliated to Anna University, Chennai-25)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Assignment Answer Sheet

Name of the Student : M. Aswini

AU Register Number: 811218405001

Assignment – 01				Date of Issue:	24.1.20	Marks	10
Course code	CP5292	Course Title	Internet of Things				
Year	I	Semester/Section	II	Date of Submission:	27.1.20		

Q.No	Questions	CO
1	How to manage Iot System Management with NETCONF-YANG	C201.1
2	What is the role of NETCONF server in IoT?	C202.2

Mark Allocation

Rubrics	Marks Allocated	Marks obtained
Content Quality	5	5
Presentation Quality	3	2
Timely submission	2	2
Total marks	10	9

B. R

Name and Signature of the Faculty Incharge

D. Hudda

HoD/CSE

Dr. G. Balakrishnan, M.E., Ph.D.,
Principal
Indra Ganesan College of Engineering
IG Valley, Madurai Main Road
Manikandam, Trichy-620 012.

INDRA GANESAN COLLEGE OF ENGINEERING

IG Valley, Manikandam, Tiruchirappalli, Tamil Nadu – 620 012, India
(Approved by AICTE, New Delhi, Affiliated to Anna University, Chennai-25)

IQAC Academic Audit Form

ACADEMIC YEAR: 2021-2022 EVEN / ODD SEMESTER

Name of Department : M.E CSE | Year / Sem / Sec : I | II | No. of Students Registered :

Details of Examination : IA Test -1 / IA Test -2 / IA Test -3 / Model Test

S.No.	Course Code	List of Reg.No Verified	Course Log Book Verified (Y / N)	Course File Verified (Y / N)	No of students Attended	No of Absentees	No of Failures	Pass %	Remarks
1	CP4291	811218405001	Yes	Yes	4	0	0	100	Good
2	CP4292	811218405002	Yes	Yes	4	0	0	100	Good
3	CP4252	811218405003	Yes	Yes	4	0	0	100	Neatly prepared
4	CP4251	811218405004	Yes	Yes	4	0	0	100	Tenely prepared

Verified by

External Member Name and Signature:

Internal Member Name and Signature:

Overall Remarks:

HoD/CSE

IQAC Co-ordinator

Principal

Dr. G. Balakrishnan, M.E., Ph.D.,
Principal
Indra Ganesan College of Engineering
IG Valley, Madurai Main Road
Manikandam, Trichy-620 012.

INDRA GANESAN COLLEGE OF ENGINEERING

IG Valley, Manikandam, Tiruchirappalli, Tamil Nadu – 620 012, India
(Approved by AICTE, New Delhi, Affiliated to Anna University, Chennai-25)

STUDENT FEEDBACK ON FACULTY
THEORY COURSE

ACADEMIC YEAR: 2019-20 SEMESTER even

Name of Department :	ME CSE	Year / Sem:	I / II	Faculty Name	Mr.D.B.RENA
Subject Code & Name	CP5292 - INTERNET OF THINGS				

S.No.	QUESTIONS	Excellent	Very Good	good	Satisfactory	Somewhat Satisfactory	Not Satisfactory
		5	4	3	2	1	0
1.	Delivery of Lectures by Interactive Communication		✓				
2.	Use of Teaching Aids and ICT			✓			
3.	Level of Preparedness & Knowledge Level		✓				
4.	Involvement in mentoring and guiding		✓				
5.	Effective Time management		✓				
6.	Is the teacher completing syllabus as per lecture schedule?	✓					
7.	Is the teacher distributing answer scripts of students as per schedule?		✓				
8.	Is the teacher addressing grievances on answer scripts of IA while distributing?		✓				
9.	Is the teacher covering content beyond syllabus (CBS)?	✓					
10.	Is the teacher punctual to class?		✓				

HoD/ CSE

IQAC Co-ordinator

Principal

RegisterNumber:

INDRAGANESANCOLLEGEOFENGINEERING

IGValley, Manikandam,Tiruchirappalli, TamilNadu–620012,India

(ApprovedbyAICTE, NewDelhiandaffiliatedtoAnnaUniversity, Chennai)

InternalAssessmentExam -I			Date/Session		Marks	50
Coursecode	CP5292	CourseTitle	Internet of Things			
Regulation	2017	Duration	90 minutes	AcademicYear	2019-20	
Year	2019-20	Semester	II	Department	CSE	

COURSEOUTCOMES

CO1:	Analyze various protocols for IoT
CO2:	Develop web services to access/control IoT devices
CO3:	Design a portable IoT using Rasperry Pi
CO4:	Deploy an IoT application and connect to the cloud
CO5:	Analyze applications of IoT in real time scenario

Q.No.	Question	CO	BTS
	PARTA (Answer all the Questions10x2 =20Marks)		
1	Define IoT and how it works	1	1
2	List and explain in brief about Features of IoT.	2	1
3	Differentiate web of things and IoT.	2	1
4	Give the basic operations in IoT.	2	2
5	List out various IoT Protocol	1	1
6	Formulate the IoT maturity levels.	2	2
7	How IoT templates are classified?	2	2
8	Summarize the application of YANG.	2	2
9	List out the features of NETCONF.	2	2
10	Bring out the system management in IoT.	3	2
	PARTB (Answer all theQuestions 2x10=20Marks)		
11a	Explain the working methodology of IoT in detail	2	2
	OR		
11b	Explain physical design in detail with an example.	2	2
12a	Write about the IoT enabling technologies ii)Explain the Categories of enabling technologies in detail	2	2
	OR		
12b	Explain the hardware's neededfor preventing intrusions in smart cities	2	2
	PARTC (Answer all theQuestions 1x10=10Marks)		
13a	Analyze in Deployment templates in detail (13)	2	2
	OR		
13b	Explain Domain specific IoT with an example	2	3

B. R
D. B. Rena 24.1.20
CourseFaculty
(Name/Sign/Date)

Dr. G. Balakrishnan, M.E., Ph.D.,
Principal
Indra Ganesan College of Engineering
IG Valley, Madurai Main Road
Manikandam, Trichy-620 012.

D. Hudd
HoD
(Name/Sign/Date)

INDRAGANESANCOLLEGEOFENGINEERING

IGValley, Manikandam,Tiruchirappalli, TamilNadu–620012,India

(ApprovedbyAICTE, NewDelhiandaffiliatedtoAnnaUniversity, Chennai)

InternalAssessmentExam -I			Date/Session		Marks	50
Coursecode	CP5292	CourseTitle	Internet of Things			
Regulation	2017	Duration	90 minutes	AcademicYear	2019-20	
Year	2019-20	Semester	II	Department	CSE	

COURSEOUTCOMES	
CO1:	Analyze various protocols for IoT
CO2:	Develop web services to access/control IoT devices
CO3:	Design a portable IoT using Rasperry Pi
CO4:	Deploy an IoT application and connect to the cloud
CO5:	Analyze applications of IoT in real time scenario

ANSWER KEY

PARTA

(Answer all the Questions 10x2 =20Marks)

1. Define IoT and how it works.

The internet of things, or IoT, is a network of interrelated devices that connect and exchange data with other IoT devices and the cloud. IoT devices are typically embedded with technology such as sensors and software and can include mechanical and digital machines and consumer objects.

An IoT ecosystem consists of web-enabled smart devices that use embedded systems -- such as processors, sensors and communication hardware -- to collect, send and act on data they acquire from their environments.

2. List and explain in brief about Features of IoT

Connectivity

Connectivity is the cornerstone of all IoT applications. Devices connected can share information and resources, helping them operate more efficiently and collaboratively. It also facilitates communication between devices and the cloud, allowing for data collection, processing, and storage. IoT devices can be connected through different communication protocols. Wired and wireless technologies are common methods for connecting devices, especially for long-distance connections that may require high data rates.

Autonomy & Interoperability

Dr. G. Balakrishnan, M.E., Ph.D.,
Principal
Indra Ganesan College of Engineering
IG Valley, Madurai Main Road
Manikandam, Trichy-620 012.

As technologies evolve, their features change and improve over time. As a relatively new technology, the IoT is evolving rapidly, with an increasing focus on autonomy and interoperability. Autonomy is a key feature of IoT that allows devices to operate without human intervention. This is especially important in industrial automation. Advanced IoT devices can sense and respond to changes in their environments. Interoperability is an essential feature of IoT that allows devices to communicate with one another across different brands, types, and protocols. Interoperable IoT devices can share data and resources and can be controlled remotely by authorized users.

Security & Privacy

Security is an essential feature of all computing systems, particularly when they are connected to the internet and collect sensitive data. IoT devices can often collect and process data, including personal information like names, addresses, and medical records. IoT devices also often have internet-facing interfaces that authorized users can access remotely. These features make them particularly vulnerable to security breaches. While security is an essential feature of IoT devices, it's important to note that security updates may not be available for all devices.

3. Differentiate web of things and IoT

    1. From the developers perspective, the WoT enables access and control over IoT resources and applications using mainstream web technologies (such as HTML 5.0, JavaScript, Ajax, PHP, Ruby n Rails, etc)
    2. The approach to building WoT is therefore based on RESTful principles and REST API s, which enable s both developers and deployers to benefit from the popularity and maturity of web technologies.
    3. Still, building the WoT has various scalability security etc challenges especially as part of a roadmap towards a global WoT.
    4. While IoT is about creating a network of objects, things, people, system and applications, WoT tries to integrate them to Web.
    5. Technically speaking WoT can be thought as flavor/Option of an application layer added over the IoT's network layer.
    6. However, the scope of the Internet of things applications is broader and includes systems that not accessible through the web (e.g. conventional WSN and RFID system)

4. Give the basic operations in IoT.

    The basic process of how IoT works is as follows: A group of physical devices is wired or wirelessly linked to each other and/or a central area. The devices collect data from the external world using some kind of sensor.

5. List out various IoT Protocol

    The Open Systems Interconnection (OSI) model provides a map of the various layers that send and receive data. Each IoT protocol in the IoT system architecture enables device-to-device, device-to-gateway, gateway-to-data center, or gateway-to-cloud communication, as well as communication between data centers.

6. Formulate the IoT maturity levels

First stage: Using IoT data to streamline processes

Second stage: Creating new revenue streams

Third stage: Using data-led insights to transform the business

Dr. G. Balakrishnan, M.E., Ph.D.,
Principal
Indra Ganesan College of Engineering
IG Valley, Madurai Main Road
[illegible]ndam, Trichy-620 012.

7. **How IoT templates are classified?**

ThingsBoard Cloud provides convenient IoT solution templates to reduce time-to-market for your IoT products. The template includes interactive dashboards, processing logic, sample devices, users and all other required entities.

8. **Summarize the application of YANG.**

Positioned as a next-generation modeling language, YANG is used to build data models. It is used to model the configuration data, status data, RPCs, and notifications used by network configuration management protocols (such as NETCONF and RESTCONF).

9. **List out the features of NETCONF.**

NETCONF Standard Features

NETCONF defines a series of standard capabilities, which enhance the NETCONF functionality and strengthen the fault tolerance and scalability. This facilitates the implementation of the NETCONF-based open network management architecture, and provides an efficient method for vendors to develop new functions.

Writable-running capability

This capability indicates that a device supports direct writes to the <running/> configuration datastore. Specifically, the device supports <edit-config> and <copy-config> operations on the <running/> configuration database.

Candidate configuration capability

This capability indicates that a device supports the <candidate/> configuration datastore, which stores a complete set of the device's configuration data. Such configuration data can be manipulated without impacting the device's current configuration.

Confirmed commit capability

This capability indicates that a device supports the <confirmed> and <confirm-timeout> parameters for the <commit> operation. This capability is mainly used in service trial run and verification scenarios.

<confirmed>: commits and converts the configuration data in the <candidate/> datastore into configuration data in the <running/> datastore.

<confirm-timeout>: specifies a timeout period for confirming the <commit> operation, in seconds. The default value is 600.

This capability is valid only when a device supports the candidate configuration capability.

Rollback-on-error capability

This capability allows a device to perform a rollback if an error occurs. Specifically, "rollback-on-error" can be carried in the <error-option> parameter of the <edit-config> operation. If an error occurs and the <rpc-error> element is generated, the server stops performing the <edit-config> operation and restores the specified configuration to the state before the <edit-config> operation is performed.

10. Bring out the system management in IoT.

IoT systems have complex software, hardware (sensors, actuators), network resources, data collection, analysis services, communication protocols, and user interfaces.

The need for managing IoT systems are:

1. **Automating Configuration:**

System management interfaces provide predicate and easy-to-use management capability to automation system configuration when a system consists of multiple devices or nodes.

Ensures all devices have the same configuration and variations or errors due to manual configurations are avoided.

2. **Monitoring Operational & Statistical Data:**

Operational data:- the system's operating parameters that are collected by the system at runtime.

Statistical data:- system performance (e.g. CPU and memory usage) data for fault diagnosis or prognosis (forecasting).

3. **Improved Reliability:**

By validating the system configurations before use.

4. **System-Wide Configuration:**

IoT systems consist of multiple devices or nodes, which have wide system configurations for the correct functioning.

Each device is configured separately (either manual or automated).

Used in system faults or undesirable outcomes.

Ensures that the configuration changes are either applied to all devices or to none.

In the failure, the configuration changes are rolled back.

5. **Multiple System Configurations:**

Some systems have multiple valid configurations according to different times or in certain conditions.

6. **Retrieving & Reusing Configurations**

Help in reusing the configurations for other devices of the same type.

Ensure that when a new device is added, the same configuration is applied.

The management system can retrieve the current configuration from a device and apply the same to the new devices.

Dr. G. Balakrishnan, M.E., Ph.D.,
Principal
Indra Ganesan College of Engineering
IG Valley, Madurai Main Road
Manikandam, Trichy-620 012.

INDRA GANESAN COLLEGE OF ENGINEERING

IG Valley, Manikandam, Tiruchirappalli, Tamil Nadu – 622 012, India
(Approved by AICTE, New Delhi and affiliated to Anna University, Chennai)

Internal Assessment Test Answer Book

Name	Harish. V			**Year/ Semester/Section**	I/II
Batch No.	8112184050002	**Date/Session**		**Department**	ME CSE
Course code	CP5291	**Course Title**	Internet of Things		
Internal Assessment Test	**IAT 1** ☑	**IAT 2** ☐	**IAT 3** ☑	**Model** ☐	
Name and Signature of the Invigilator with date					

Instruction to the Student: Put tick mark to the question attended in the column against question.

Part A			Part B / Part C					Total Marks
Q. No.	✓	Marks	Q. NO.	✓	a Marks	✓	b Marks	
1		2	11		10			
2		2	12				10	
3		2	13		10			
4		1	14					
5		2	15					
6		1	16					
7		2					Total	30
8		2						
9		2						
10								
Total		16	Grand Total: 46				Name and Signature of the Examiner with date	

To be filled by the examiner

Course Outcomes	1	2	3	4	5	6	Total
Marks allotted							
Marks Obtained							

IQAC Audit - Remarks

Name and Signature of the IQAC member

Dr. G. Balakrishnan, M.E., Ph.D.,
Principal
Indra Ganesan College of Engineering
IG Valley, Madurai Main Road
Manikandam, Trichy-620 012.

INDRA GANESAN COLLEGE OF ENGINEERING

IG VALLEY, MANIDANDAM, TIRUCHIRAPPALLI – 620012

DEARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

ACADEMIC YEAR 2021 – 2022 (EVEN SEMESTER)

STUDENTS MARK STATEMENT- CO BASED

INTERNAL ASSESSMENT I

SUBJECT CODE &TITLE: CP5292&INTERNRT OF THINGS

YEAR/SEM: IM.E/I I **MONTH & YEAR:** OCT 2020

S.NO	REG NO	STUDENT NAME	C224.1 (25)	C224.2 (25)	TOTAL (50)	TOTAL (100)
1.	811218405001	Aswini. M	15	14	29	58
2.	811218405002	Gwendolyn Rosetta.G	14	13	27	54
3.	811218405003	Harish.V	13	13	26	52
4.	811218405004	Nirmala.N	20	10	30	60

MARKS RANGE:

<20	20-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100
0	0	0	0	4	0	0	0	0

Total No.of Candidates Present	4
Total No.of Candidates Absent	0
Total No.of Students Pass	4
Total No. of Students Fail	0
Percentage of Pass	100%

STAFF INCHARGE HoD/CSE PRINCIPAL

Dr. G. Balakrishnan, M.E., Ph.D.,
Principal
Indra Ganesan College of Engineering
IG Valley, Madurai Main Road
Manikandam, Trichy-620 012.