INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad -500 043

INFORMATION TECHNOLOGY

COURSE DESCRIPTOR

Course Title	INTERNET OF THINGS (IoT)				
Course Code	ACS510				
Programme	B. Tech				
Semester	VI	CSE	IT		
Course Type	Elective				
Regulation	IARE - R16				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	3	-	3	-	-
Chief Coordinator	Ms. N.M Deepika, Assistant Professor, CSE				
Course Faculty	Dr. Chukka Santhaiah, Associate Professor, CSE Ms. P. Navya, Assistant Professor, IT				

I. COURSE OVERVIEW:

The course covers the concepts of data communication, computer networks, cloud computing and network security fundamental techniques, customs and terms including the basic components of hardware and software. This course helps the students in gaining the knowledge about the sensor devices, mathematical and engineering problems. This course helps to undertake future courses that assume this course as a background in networks and security.

II. COURSEPRE-REQUISITES:

Level	Course Code	Semester	Prerequisites
UG	AIT003	IV	Computer Networks

III. MARKS DISTRIBUTION:

Subject	SEE Examination	CIA Examination	Total Marks
Internet of Things	70 Marks	30 Marks	100

IV. DELIVERY /INSTRUCTIONALMETHODOLOGIES:

✔	Chalk & Talk	✔	Quiz	✔	Assignments	✔	MOOCs
✔	LCD / PPT	✔	Seminars	✘	Mini Project	✘	Videos
✘	Open Ended Experiments						

V. EVALUATION METHODOLOGY:

The course will be evaluated for a total of 100 marks, with 30 marks for Continuous Internal Assessment (CIA) and 70 marks for Semester End Examination (SEE). Out of 30 marks allotted for CIA during the semester, marks are awarded by taking average of two CIA examinations or the marks scored in the make-up examination.

Semester End Examination (SEE): The SEE is conducted for 70 marks of 3 hours duration. The syllabus for the theory courses is divided into five units and each unit carries equal weight age in terms of marks distribution. The question paper pattern is as follows. Two full questions with "either" or "choice" will be drawn from each unit. Each question carries 14 marks. There could be a maximum of two sub divisions in a question.

The emphasis on the questions is broadly based on the following criteria:

50 %	To test the objectiveness of the concept.
50 %	To test the analytical skill of the concept OR to test the application skill of the concept.

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks (Table 1), with 25 marks for Continuous Internal Examination (CIE), 05 marks for Quiz/ Alternative Assessment Tool (AAT).

Table 1: Assessment pattern for CIA

Component	**Theory**		**Total Marks**
Type of Assessment	CIE Exam	Quiz / AAT	
CIA Marks	25	05	30

Continuous Internal Examination (CIE):
Two CIE exams shall be conducted at the end of the 8^{th} and 16^{th} week of the semester respectively. The CIE exam is conducted for 25 marks of 2 hours duration consisting of two parts. Part–A shall have five compulsory questions of one mark each. In part–B, four out of five questions have to be answered where, each question carries 5 marks. Marks are awarded by taking average of marks scored in two CIE exams.

Quiz / Alternative Assessment Tool (AAT):
Two Quiz exams shall be online examination consisting of 25 multiple choice questions and are be answered by choosing the correct answer from a given set of choices (commonly four). Marks shall be awarded considering the average of two quizzes for every course. The AAT may include seminars, assignments, term paper, open ended experiments, five minutes video and MOOCs.

VI. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes (POs)		Strength	Proficiency assessed by
PO 1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	3	Presentation on real-world problems
PO 2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences	2	Assignment
PO 3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	1	Assignment/ Term paper/ Mini projects

3 = High; 2 = Medium; 1 = Low

VII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes (PSOs)		Strength	Proficiency assessed by
PSO 1	**Professional Skills:** The ability to research, understand and implement computer programs in the areas related to algorithms, system software, multimedia, web design, big data analytics, and networking for efficient analysis and design of computer-based systems of varying complexity.	2	Lectures/ Assignments
PSO 2	**Software Engineering Practices:** The ability to apply standard practices and strategies in software service management using open-ended programming environments with agility to deliver a quality service for business success	2	Seminars
PSO 3	**Successful Career and Entrepreneurship:** The ability to employ modern computer languages, environments, and platforms in creating innovative career paths, to be an entrepreneur, and a zest for higher studies.	2	Guest lectures

3 = High; 2 = Medium; 1=Low

VIII. COURSE OBJECTIVES(COs):

The course should enable the students to:	
I	Understand the architecture of Internet of Things and connected world.
II	Explore on use of various hardware and sensing technologies to build IoT applications.
III	Illustrate the real time IoT applications to make smart world.
IV	Understand the available cloud services and communication API„s for developing smart cities.

IX. COURSE OUTCOMES(COs):

COs	Course Outcome	CLOs	Course Learning Outcome
CO 1	Understand the architecture of Internet of Things and connected world.	CLO 1	Understand and intuition of the whole process line of extracting knowledge from data about the Internet of Things.
		CLO 2	Deep insight in one of the specializations within the network, depending on the study and the choice of the concepts of IoT.

		CLO 3	Solid knowledge in a broad range of methods based on design and implementation of IoT in network performance, analysis and problem solving with design of networks
CO 2	Explore the use of various hardware and sensing technologies to build IoT applications.	CLO 4	Experience in deriving theoretical properties of methods involved in IoT.
		CLO 5	Design and implementation/modification of methods involved in IoT.
		CLO 6	Describe what IoT is and the skill sets needed to be a network analysis.
CO 3	Illustrate the real time IoT applications to make smart world.	CLO 7	Motivate and explain trade-offs in IoT tool technique design and analysis of applications with IoT.
		CLO 8	Understand significance of models in IoT.
		CLO 9	Describe the Transport layer protocols and how its uses in IoT
		CLO 10	Apply basic IoT algorithms for predictive network performance.
		CLO 11	Understand basic terms what security issues. Identify key distribution methods.
		CLO 12	Identify common approaches used for feature Generation of IoT.
CO 4	Understand the available cloud services and communication API„s for developing smart cities.	CLO 13	Identify common approaches used for feature Generation of IoT.
		CLO 14	Create effective results by using various techniques in IoT application.
		CLO 15	Analyze the importance of IoT applications and work effectively as individual or teams on various IoT projects.

X. COURSE LEARNING OUTCOMES(CLOs):

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's Mapped	Strength of Mapping
ACS510.01	CLO 1	Understand and intuition of the whole process line of extracting knowledge from data about the Internet of Things.	PO1; PO2	2
ACS510.02	CLO 2	Deep insight in one of the specializations within the network, depending on the study and the choice of the concepts of IoT.	PO1	2
ACS510.03	CLO 3	Solid knowledge in a broad range of methods based on design and implementation of IoT in network performance, analysis and problem solving with design of networks.	PO3	2
ACS510.04	CLO 4	Experience in deriving theoretical properties of methods involved in IoT.	PO1	3
ACS510.05	CLO 5	Design and implementation/modification of methods involved in IoT.	PO2	2
ACS510.06	CLO 6	Describe what IoT is and the skill sets needed to be a network analysis.	PO3	2
ACS510.07	CLO 7	Use IoT design to carry out basic statistical modeling and analysis.	PO3	2
ACS510.08	CLO 8	Motivate and explain trade-offs in IoT tool technique design and analysis of applications with IoT.	PO2	1
ACS510.09	CLO 9	Understand significance of models in IoT.	PO1	3
ACS510.10	CLO 10	Describe the transport layer protocols and how its uses in IoT	PO1; PO3	2

ACS510.11	CLO 11	Apply basic IoT algorithms for predictive network performance.	PO2	1
ACS510.12	CLO 12	Understand basic terms what security issues. Identify key distribution methods.	PO3	1
ACS510.13	CLO 13	Identify common approaches used for feature Generation of IoT.	PO3	1
ACS510.14	CLO 14	Create effective results by using various techniques in IoT application.	PO1	2
ACS510.15	CLO 15	Analyze the importance of IoT applications and work effectively as individual or teams on various IoT projects.	PO1; PO2	2

3 = High; 2 = Medium; 1 = Low

XI. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES

Course Outcomes (COs)	Program Outcomes(POs)			Program Specific Outcomes (PSOs)		
	PO 1	PO 2	PO 3	PSO1	PSO2	PSO3
CO 1	3	2			3	
CO 2	2			2		
CO 3	3	3	1		3	
CO 4	2	2	2	2		1

3 = High; 2 = Medium; 1 = Low

XII. MAPPING COURSE LEARNING OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAMSPECIFICOUTCOMES:

(CLOs)	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CLO 1		3											2	3	
CLO 2	3	3												3	
CLO 3	3													3	1
CLO 4		3												3	
CLO 5	3	3											2		
CLO 6		3	2											3	1
CLO 7	3	3											2		
CLO 8			2											3	
CLO 9		3											2		1
CLO 10		3												3	
CLO 11			2										2		1

CLO 12	3												2	3	
CLO 13	3		2											3	1
CLO 14													2	3	
CLO 15	3													3	

3 = High; 2 = Medium; 1 = Low

XIII. ASSESSMENTMETHODOLOGIES–DIRECT

CIE Exams	PO1; PO2; PO3	SEE Exams	PO1; PO2; PO3	Assignments	PO2; PO3	Seminars	PO 1
Laboratory Practices	PO1	Student Viva	-	Mini Project	PO3	Certification	-
Term Paper	PO3						

XIV. ASSESSMENTMETHODOLOGIES-INDIRECT

✔	Early Semester Feedback	✔	End Semester OBE Feedback
✘	Assessment of Mini Projects by Experts		

XV. SYLLABUS

UNIT-I	**INTRODUCTIONTO INTERNET OF THINGS (IoT)**
Definition and characteristics of IoT, physical design of IoT, logical design of IoT, IoT Enabling technologies, IoT levels and deployment, domain specific IoTs.	
UNIT-II	**IoT AND M2M**
Introduction, M2M, difference between IoT and M2M, software defined networking (SDN) and network function virtualization (NFV) for IoT, basics of IoT system management with NETCONF-YANG.	
UNIT-III	**IoT ARCHITECTURE AND PYTHON**
IoT Architecture: State of the art introduction, state of the art; Architecture reference model: Introduction, reference model and architecture, IoT reference model. Logical design using Python: Installing Python, Python data types and data structures, control flow, functions, modules, packages, file handling.	
UNIT-IV	**IoT PHYSICAL DEVICES AND ENDPOINTS**
Introduction to Raspberry Pi interfaces (Serial, SPI, I2C), programming Raspberry PI with Python, other IoT devices.	
UNIT-V	**IoT PHYSICAL SERVERS AND CLOUD OFFERINGS**
Introduction to cloud storage models and communication APIs; WAMP: AutoBahn for IoT, Xively cloud for IoT; Case studies illustrating IoT design: Home automation, smart cities, smart environment.	
Text Books:	
1. ArshdeepBahga, Vijay Madisetti, "Internet of Things: A Hands-on-Approach", VPT, 1st Edition, 2014. 2. Matt Richardson, Shawn Wallac, "Getting Started with Raspberry Pi, O"Reilly (SPD)", 3rd Edition, 2014. 3. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", Springer.	
Reference Books:	
1. Adrian McEwen, Hakim Cassimally, "Designing the Internet of things", John Wiley and sons, 1stedition, 2014. 2. Francis DaCosta, "Rethinking "The Internet of Things":A Scalable Approach to Connecting Everything", A press Publications, 1st Edition, 2013.	

XVI. COUSE PLAN:

The course plan is meant as a guideline. Probably there may be changes.

Lecture No	Topics to be covered	Course Learning Outcomes (CLOs)	Reference
1	Understanding the basics concepts of IoT	CLO1	T1:19
2	Motivations of IoT and various Applications of IoT	CLO3	T1:22
3	Describe the Things of IoT and characteristics of IoT	CLO3	T1:24
4-6	Analysis and Design of IoT in physical view	CLO5	T1:24
7-8	Understandings the Logical design of IoT	CLO5	T1:31
9-10	Describing various IoT enabling technologies	CLO5	T1:34-49
11-12	Identifying specific Domains IoTs	CLO4	T1:53-72
13	Understanding the basic differences between IoT and M2M	CLO6	T1: 6.16.4
14	Implementation of SDN and NFV architecture in IoT	CLO9	T1:80-85
15	Identifying IoT system management with NETCONF-YANG	CLO8	T1:91-92
16	Uses of SNMP in IoT protocols	CLO9	T1:93-94
17-18	Implementation of NETCONF-YANG by using Python	CLO10	T1:96-97
19-21	Development of IoT Architecture with standards	CLO7	T3:170-86
22-27	Logical design of IoT using Python	CLO5	T1:141-50
28-35	Describe the physical endpoints used in IoT	CLO11	T1:186-96
36-38	Identifying the various IoT physical servers and cloud offerings	CLO12	T1:197-98
39-45	Real time applications of IoT with Case studies design	CLO15	T1:254-64

XVII. GAPS IN THE SYLLABUS - TO MEET INDUSTRY /PROFESSIONREQUIREMENTS:

S. No	Description	Proposed actions	Relevance with POs	Relevance with PSOs
1	IoT devices implementation	Assignments	PO2; PO3	PSO1
2	IoT real time examples	Seminars / NPTEL	PO2; PO3	PSO1; PSO3
3	IoT Securities Issues	Seminars /NPTEL	PO1; PO3	PSO1;PSO3

Prepared by:

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