INSTITUTE OF AERONAUTICAL ENGINEERING

(AUTONOMUS)
Dundigal, Hyderabad - 500 043

ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE INFORMATION SHEET

Course Title	**INTERNET OF THINGS**			
Course Code	**BES006**			
Regulation	**R17**			
Semester	**II-SEM**			
Program	**M.Tech**			
Course Structure	Lectures	Tutorials	Practicals	Credits
	3	-	-	3
Course Coordinator	DR. K.RameshBabu, Professor ,ECE			
Course Faculty	Shashikanth Reddy, AssistantProfessorECE			

I. COURSE OVERVIEW:

This course starts by introducing some basic issues, policies and challenges in internet .After that understand various protocols and their behavior in IOT environment. Next we build a low cost embedded system and we develop a embedded communication software to interface the interface the protocols using various protocol based management techniques. Next we operate various modes of communication in IOT environment using embedded software application. Next we design a enabling constrained devices in the cloud environment of IOT. Finally we implement case studies like E-Health source platform and be close elderly monitoring in IOT Environment.

II. PREREQUISITE(S):

Level	Credits	Course Code	Periods/ Week	Prerequisites
PG	3	AEC103	3	Microprocessors and Microcontrollers, Digital System Design, Assembly and C Programming, Basic Processor Architecture.

III. MARKS DISTRIBUTION

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

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.

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

Continuous Internal Examination (CIE):
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 20 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, micro projects, five minutes video and MOOCs.

IV. DELIVERY / INSTRUCTIONAL METHODOLOGIES:

√	CHALK & TALK	√	QUIZ	√	ASSIGNMENTS	√	MOOCs
√	LCD / PPT	√	SEMINARS	√	MINI PROJECT	√	VIDEOS
√	OPEN ENDED EXPERIMENTS						

V. ASSESSMENT METHODOLOGIES – DIRECT

√	CIE EXAMS	√	SEE EXAMS	√	ASSIGNEMNTS	√	SEMINARS
√	LABORATORY PRACTICES	√	STUDENT VIVA	√	MINI PROJECT	√	CERTIFICATION
√	TERM PAPER						

VI. ASSESSMENT METHODOLOGIES – INDIRECT

√	ASSESSMENT OF COURSE OUTCOMES (BY FEEDBACK, ONCE)	√	STUDENT FEEDBACK ON FACULTY (TWICE)
√	ASSESSMENT OF MINI PROJECTS BY EXPERTS		

VII. COURSE OBJECTIVES:

At the end of the course, the students will be able to:

i. Learn the basic issues, policy and challenges in the Internet
ii. Understand the components and the protocols in Internet
iii. Build a small low cost embedded system with the internet
iv. Understand the various modes of communications with internet
v. Learn to manage the resources in the Internet
vi. Deploy the resources into business
vii. Understand the cloud and internet environment.

VIII . COURSE LEARNING OUTCOMES:

Students, who complete the course, will have demonstrated the ability to do the following:

CBES006.01	Identify and analyze the constraints and characteristics of processor architectures, Hardware, software partitioning distributed system..
CBES006.02	Understand the interfacing concept with memory subsystem organization and input/output subsystem organization.
CBES006.03	Understand instruction types, addressing modes and their formats in the assembly language programs.
CBES006.04	Describe the instruction set architecture design for relatively simple microprocessor or Central Processing Unit.
CBES006.05	Understand the typical computer hardware and software components and computer technology trends..
CBES006.06	Understand the register transfer languages and micro operations involved in bus and memory transfers.
CBES006.07	Understand the future developments in emulation and prototyping architecture specialization techniques, system communication infrastructure target architectures.
CBES006.08	Understand the connections among the circuits and the functionalities in the hardwired control unit.
CBES006.09	Describe the various phases involved in the instruction cycle viz. fetching, decoding, reading effective address and execution of instruction.
CBES006.10	Apply the practical consideration in a compiler development environment.
CBES006.11	Classify the various instructions formats to solve the arithmetic expressions in different addressing modes.
CBES006.12	Understand the functionality of various instruction formats for writing assembly language programs.
CBES006.13	Describe the implementation of fixed point and floating point addition, subtraction operations.
CBES006.14	Understand the concept of memory hierarchy and different typed of memory chips.
CBES006.15	Describe various modes of data transfer between CPU and I/O devices
CBES006.16	Analyze the level specification, design representation for system level synthesis system design-I and design-II.
CBES006.17	Describe the hardware organization of associate memory and understand the read and write operations
CBES006.18	Describe the parallel processing concept with multiple functional units.
CBES006.19	Understand the multiprocessor concept with system bus structure and the concept of inter processor communication and synchronization
CBES006.20	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
CBES006.21	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change
CBES006.22	Possess the knowledge and skills to design advanced computer architecture for current industry requirements.

IX. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes		Level	Proficiency assessed by
PO1	**Engineering Knowledge** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems	H	Assignments, Tutorials
PO2	**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	S	Assignments
PO3	**Design/Development of Solutions** Design solutions for complex meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations	S	Real time Applications
PO4	**Conduct Investigations of Complex Problems** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions	S	Real time Applications

PO5	**Modern Tool Usage** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations	S	Projects
PO6	**The Engineer and Society** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice	N	--
PO7	**Environment and Sustainability** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development	S	Assignments
PO8	**Ethics** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice	N	--
PO9	**Individual and Team Work** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings	N	--
PO10	**Communication** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions	S	Presentations
PO11	**Project Management and Finance** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments	S	Seminars, Discussions
PO12	**Life-long Learning** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change	H	Development of Prototype, Projects

N - None **S - Supportive** **H - Highly Related**

X. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes		Level	Proficiency assessed by
PSO1	**Professional Skills:** An ability to understand the basic concepts in Electronics & Communication Engineering and to apply them to various areas, like Electronics, Communications, Signal processing, VLSI, Embedded systems etc., in the design and implementation of complex systems.	H	Lectures, Assignments
PSO2	**Problem-solving skills:** An ability to solve complex Electronics and communication Engineering problems, using latest hardware and software tools, along with analytical skills to arrive cost effective and appropriate solutions.	S	Tutorials
PSO3	**Successful career and Entrepreneurship:** An understanding of social-awareness & environmental-wisdom along with ethical responsibility to have a successful career and to sustain passion and zeal for real-world applications using optimal resources as an Entrepreneur.	S	Seminars and Projects

N - None **S - Supportive** **H - Highly Related**

XI. SYLLABUS:

UNIT-I :

INTRODUCTION :

Definition – phases – Foundations – Policy– Challenges and Issues - identification - security – privacy. Components in internet of things: Control Units – Sensors – Communication modules – Power Sources – Communication Technologies – RFID – Bluetooth – Zigbee – Wifi – RFlinks – Mobile Internet – Wired Communication.

UNIT-II:

PROGRAMMING THE MICROCONTROLLER FOR IOT :

Ecosystem, embedded communications software, software partitioning, module and task decomposition: Partitioning case study , protocol software, debugging protocols, tables and other data structures, table access routines, buffer and timer management, management software, device and router management: CLI based management and HTTP based management, agent to protocol interface, device to manager communication, system setup, boot and post-boot configuration, saving and restoring the configuration.

UNIT-III RESOURCE MANAGEMENT IN THE INTERNET OF THINGS : Clustering - Software Agents - Data Synchronization - Clustering Principles in an Internet of Things Architecture - The Role of Context - Design Guidelines -Software Agents for Object. Data Synchronization- Types of Network Architectures

1. Fundamental Concepts of Agility and Autonomy-Enabling Autonomy and Agility by the Internet of Things-Technical Requirements for Satisfying the New Demands in Production - The Evolution from the RFID-based EPC Network to an Agent based Internet of Things- Agents for the Behaviour of Objects.

UNIT-IV BUSINESS MODELS FOR THE INTERNET OF THINGS :

The Meaning of DiY in the Network Society- Sensor-actuator Technologies and Middleware as a Basis for a DiY Service Creation Framework - Device Integration - Middleware Technologies Needed for a DiY 32 | P a g e Internet of Things Semantic Interoperability as a Requirement for DiY Creation -Ontology- Value Creation in the Internet of Things-Application of Ontology Engineering in the Internet of Things-Semantic Web-Ontology - The Internet of Things in Context of EURIDICE - Business Impact.

UNIT-V FROM THE INTERNET OF THINGS TO THE WEB OF THINGS:

Resource-oriented Architecture and Best Practices- Designing REST ful Smart Things - Web- enabling Constrained Devices - The Future Web of Things - Set up cloud environment – send data from microcontroller to cloud – Case studies – Open Source e-Health sensor platform – Be Close Elderly monitoring – Other recent projects.

Text Books:

1. CharalamposDoukas , Building Internet of Things with the Arduino, Create space, April2002 Dieter Uckelmann et.al, “Architecting the Internet of Things”, Springer,2011.

Reference Books:

1.LuigiAtzor et.al, “The Internet of Things: A survey, “, Journal on Networks, Elsevier Publications, October 2010 .

Web References:

4. http://postscapes.com/
5. http://www.theinternetofthings.eu/what-is-the-internet-of-things

E-Text Books:

1. https://mitpress.mit.edu/books/internet-things
2. http://atkinsapps.uncc.edu/etextbooks
3. https://cloud.oracle.com/iot?tabname=LearnMoreInfo&lmResID=1441186561464

XII. COURSE PLAN:

At the end of the course, the students are able to achieve the following course learning outcomes:

Lecture No.	CLO	Unit	Learning Objective	Topics to be covered	Reference
Course Content Delivery --- Lecture Wise Break-up of Topics					
I SPELL					
1-3	1.		**Define** phases and foundation, policy of internet of things.	Introduction of internet of things	**R6 1.1, 1.4**
4-5	2.		**List out**Challenges and Issues in internet of things.	challenges andits issues in IOT	**R6 1.5-14**
6	3.		**Define** the concept of security and privacy IOT	Security and privacy of IOT	**R6 1.36**
7-10	4.		**Explain** the control units used in internet of things	Control units used in internet of things	**R6 1.17**
11	5.		**Describe** communication modules used in IOT	Communication modules in IOT	**R7 6.3(II)**
12-15	6.	**I**	**Classify** various communication technologies used in IOT	Various communication technologies used in IOT	**R6 2.36**
16-17	7.		**Summarize** the RF links and mobile internet used in IOT environment	RF links and mobile internet used in IOT	**R6 2.2.4,5,2.3, 2.4.1**
18	8.		**Explain** about protocols software and debugging tools used in IOT environment	Protocols and software debugging tools in IOT	**R6 3.3.1**
19-20	9.		**Evaluate** table access routines and other data structures used in IOT	Table access routines and other data structures in IOT	**R6 3.5,6,7,8**
21-22	10.	**II**	**Describe** buffer and timer management used in IOT	Buffer and Timer management in IOT	**R6 3.9**
23	11.		**Distinguish**CLI based management and HTTP Management	CLI and HTTP management	**R6 3.10**

24	12.		**Explain** boot and post boot configuration in microcontroller IOT	Boost and post boot configuration in IOT	**R6 3.11**
25-26	13.		**Analyze** storing and restoring configuration using microcontroller in IOT environment	Storing and restoring configuration in IOT	**R6 3.4**
Lecture No.	**CLO**	**Unit**	**Learning Objective**	**Topics to be covered**	**Reference**
27-29	14.		**Summarize** concepts of data synchronization used in IOT	Data synchronization in IOT	**T3 2.1,2,3,4**
30-32	15.		**Describe** Clustering of things in IOT architecture	Clustering of things in IOT	**T3 3.1,.2.1**
33	16.		**Sketch** the design of IOT and its software agents	Iot design and its software agents	**R6 5.1,.2**
34	7.		**Classify** architectures used in	Architectures of IOT	**R6 5.4**
35-36	18.	**III**	**Explain** the concept of agility and autonomyand how it is enabled in IOT	Concept of agility and autonomy and enabling in IOT	**R6 5.5,.6**
37-40	19.		**List** outTechnical requirements satisfying the new demands Of roduction in IOT	Technical requirements satisfy new demands in IOT	**R6 5.7,.8**
Course Content Delivery --- Lecture Wise Break-up of Topics					
II SPELL					
41	20.		**Explain** the Evolution from RFIDbased EPC network to agent based IOT	Evolution of RFID based network to agent based IOT	**R6 6.4,.2,.3**
42-45	21.	**III**	**Summarize** the agents of behavior of objects in IOT	behaviourAgents of objects in IOT	**R6 6.5,-6.10**
46-47	22.		**Explain** DiY in the network society of IOT	Di Y in the network society of IOT	**R6 6.12,13**
48	23.		**Describe** sensors and actuator technologies and middle ware in network society of IOT	Sensor and actuator technologies and middleware in network society of IOT	**R6 6.14,15**
49-55	24.	**IV**	**Classify** Middleware technologies needed for DiY internet of things	Middle ware technologies needed for DiY internet of things	**R6 7.5-.7,.11,.12, .13,**
56-58	25		**Illustrate**the context of IOT in EURIDICE - Business Impact	Context of IOT in EURIDICE – business impact	**R6 7.8,9,10,11**
59-60	26.			**Explain** brieflythe application of ontology engineering in internet of things	Application of ontology engineering in internet of things

Lecture No.	CLO	UNIT	Learning Objective	Topics to be covered	Reference
59	27.	V	**Design** REST full Smart Things and web enabling constrained devices in IOT environment	Design REST full smart things and web enabling constrained devices in IOT environment	**R8 5.1**
60-63	28		**Explain** about web enabling constrained devices in IOT	Web enabling constrained devices in IOT	**R8 5.2,.3,.4,.5**
64	29.		**Summarize** the set up from micro controller to cloud in IOT	Set up from microcontroller to cloud in IOT	**R6 8.10,**
65-66	30.		**Explain** Case study – Open Source e-Health sensor platform	Set up from microcontroller to cloud in IOT	**R6 8.9,.11,.14**
67-68	31.		**Define** case study of be close elderly monitoring	Case study of be close elderly monitoring	**R6 8.15**

XIII GAPS IN THE SYLLABUS - TO MEET INDUSTRY / PROFESSION REQUIREMENTS:

S NO	DESCRIPTION	PROPOSED ACTIONS	RELEVANCE WITH POs	RELEVANCE WITH PSOs
1	Data Representation – Arithmetic multiplication , division	Seminars / Guest Lectures / NPTEL	PO 1, PO 2, PO 3	PSO 1, PSO 2
2	RISC ,CISC Characteristics	Seminars / Guest Lectures / NPTEL	PO 2, PO 3	PSO 1
3	Vector Processing	Assignments / Laboratory Practices	PO 1, PO 3, PO 4	PSO 2

XIV MAPPING COURSE OBJECTIVES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Objectives	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
I	H		S					S			S	H		S	S
II	H				S		S				S		H	S	
III		S			S			S				H	H	S	
IV	H			S	S		S	S		S	S			S	
V	H			H			S	S		S	S			S	H

XV MAPPING COURSE OBJECTIVES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course learning Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CBES006.01			H					H					S		
CBES006.02	S	S								S	H		H		
CBES006.03					H		S							S	
CBES006.04			S										H		
CBES006.05	H		H						H				S		
CBES006.06					H							S	S		
CBES006.07			H	S										S	
CBES006.08		H		S				H			S		S		
CBES006.09		H													
CBES006.10				S			H							H	
CBES006.11	S													S	
CBES006.12					H						S		S		
CBES006.13	S													S	
CBES006.14					H				S		S			S	
CBES006.15		S	H						S				S	H	
CBES006.16														S	
CBES006.17	S	S					S							H	
CBES006.18		H								S				S	
CBES006.19	S												S		
CBES006.20				H										S	
CBES006.21															
CBES006.22	S			S											

S= Supportive **H = Highly Related**

XVI. DESIGN BASED PROBLEMS (DP) / OPEN ENDED PROBLEM:

1. Differentiate power PC processor based and Mocro Blaze processor based embedded system
2. What are the processor architectures should be taken into consideration while designing an Embedded system

1. Explain about Board memories of an Embedded system a. ROM b. RAM c. Auxiliary memory

4. Explain about Aptix Prototyping System and Explain about Architecture of 8051 Micro Controller

5. Briefly explain about Compiler validation. Explain about The Co-design Computational model.

6. What are the processor architectures should be taken into consideration while designing an embedded system

Prepared by:

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