INSTITUTE OF AERONAUTICAL ENGINEERING

(AUTONOMUS)
Dundigal, Hyderabad - 500 043

ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE DESCRIPTION FORM

Course Title	**EMBEDDED WIRELESS SENSOR NETWORKS**			
Course Code	**BES210**			
Course Structure	Lectures	Tutorials	Practicals	Credits
	3	-	-	3
Course Coordinator	Ms Shreya Verma, AssistanProfessor,ECE			
Team of Instructors	Ms Shreya Verma, Assistant Professor, ECE			

I. COURSE OVERVIEW:

This course starts by introducing some basic ideas of wireless sensor networks and its requirements. Subsequently the course covers architectural design of wireless sensor network. As we progress with the course students will be familiarized with the programming models as well as protocols which govern the sensor network and its applications in real world.

II. PREREQUISITE(S):

Level	Credits	Periods/ Week	Prerequisites
PG	3	3	Embedded WSN

III. MARKS DISTRIBUTION:

Sessional Marks	University End Exam Marks	Total Marks
Midterm Test There shall be two midterm examinations. Each midterm examination consists of essay paper and assignment. The essay paper is for 25 marks of 60 minutes duration and shall contain 4 questions. The student has to answer 2 questions, each carrying 5 marks. First midterm examination shall be conducted for the first two and half units of syllabus and second midterm examination shall be conducted for the remaining portion. Five marks are marked for assignments. There shall be two assignments in	70	100

Sessional Marks	University End Exam Marks	Total Marks
every theory course. Assignments are usually issued at the time of commencement of the semester. These are of problem solving in nature with critical thinking. Marks shall be awarded considering the average of two midterm tests in each course.		

IV. EVALUATION SCHEME:

S. No	Component	Duration	Marks
1.	I Mid Examination	120 minutes	25
2.	I Assignment	-	5
3.	II Mid Examination	120 minutes	25
4.	II Assignment	-	5
5.	External Examination	3 hours	70

V. COURSE OBJECTIVES:

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

1. Familiarize the students with the concept of wireless sensor networks.
2. Understand programming in wireless sensor networks.
3. Analyze sensor networks for various applications.
4. Apply sensor network to be used in embedded WSN.

VI. COURSE OUTCOMES:

After completing this course the student must demonstrate the knowledge and ability to:

1. Understand the concept of wireless sensor network and its applications in embedded system.
2. Acquire knowledge of various network architecture of wireless sensor network.
3. Design wireless sensor network using programming techniques.
4. Familiarize with programming models, system architecture of wireless sensor network.
5. Analyze real time application of sensor network in embedded system.

VII. 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 engineering problems and design system components or processes that	H	Mini Projects

Program Outcomes		Level	Proficiency assessed by
	meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental Considerations		
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	H	Projects
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	S	Oral Discussions
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**

VIII. 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	S	Seminars and Projects

Program Specific Outcomes		Level	Proficiency assessed by
	applications using optimal resources as an Entrepreneur.		

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

IX. SYLLABUS:

UNIT -I:
INTRODUCTION TO WSN:-Introduction to WSN, challenges for WSNs, characteristic requirements, required mechanisms, single node architecture, hardware components, energy consumption of sensor nodes, operating systems and execution environments, some examples of sensor nodes.

UNIT-II:
NETWORK ARCHITECTURE:-Sensor network scenarios, optimization goals and figures of merit, design principles for WSNs, service interfaces of WSNs, gateway concepts.

UNIT-III:
SENSOR NETWORK IMPLEMENTATION:- Sensor programming, introduction to tiny OS programming and fundamentals of programming sensors using nes C.

Algorithms for WSN: Techniques for protocol programming.

UNIT-IV:
PROGRAMMING MODELS:-An introduction to the concept of cooperating objects and sensor networks, system architectures and programming models.

UNIT-V:
CASE STUDIES:- Wireless sensor networks for environmental monitoring, wireless sensor networks with mobile nodes, autonomous robotic teams for surveillance and monitoring, Inter-vehicle communication networks.

TEXT BOOKS:

1. Holger karl, Andreas Willig, "Protocols and architectures for wireless sensor networks", John Wiley, 1st Edition, 2005.

2. Liljana Gavrilovska, Srdjan Krco, Veljko Milutinovic, Ivan Stojmenovic, Roman Trobec, "Application and Multiidisciplinary Aspects of Wireless Sensor Networks", Springer, London Limited, 1st Edition, 2011.

REFERENCE BOOKS:

1. Michel Banatre, Pedro Jose Marron, Anibal Ollero, A. Dam Wolisz, "Cooperating Embedded Systems and Wireless Sensor Networks", John Wiley & Sons, 1st Edition, 2008.
2. Seetharaman Iyengar, Nandhan, "Fundamentals of Sensor Network Programming Applications and Technology", John Wiley & Sons, 1st Edition, 2008.

X. 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
I SPELL					
1-3	1.	I	**Understanding** the basic concept of wireless sensor network	Introduction to WSN, challenges for WSNs, characteristic requirements,	**Textbook 1**
4-5	2.		**Familiarization** to architecture of wireless sensor network and its hardware components	Required mechanisms, single node architecture, hardware components	**Textbook 1**
6	3.		**Analyze** the energy consumption in wireless sensor network	Energy consumption of sensor nodes	**Textbook 1**
7-10	4.		**Study** of operating system and its operating environment	Operating systems and execution environments	**Textbook 1**
11	5.		**Application** of wireless sensor network	Examples of sensor nodes	**Textbook 1**
12-15	6.	**II**	**Examine** the various sensor network scenarios	Sensor network scenarios	**Textbook 1**
16-17	7.		**List** the optimization goals of wireless sensor network and its figure of merit	Optimization goals and figures of merit	**Textbook 1**
18	8.		**Discuss** the various principles involved in the designing of a wireless sensor network	Design principles for WSNs	**Textbook 1**
19-20	9.		**Understand** the interfaces used for providing service in WSN	Service interfaces of WSNs	**Textbook 1**
21-22	10.		**Describe** the transfer of information from source to destination using gateway concept	Gateway concepts	**Textbook 1**

24	11.	III	**Describe** the programming of sensors in wireless sensor network	Sensor programming,	**Textbook 1**
25-26	12.		**Define** the tiny operating system and programming	Introduction to tiny OS programming	**Textbook 1**
27-29	13.		**Execution** of programming sensors	Fundamentals of programming sensors using nes C	**Textbook 1**
30-32	14.		**Understand** the algorithms used in wireless sensor network	Algorithms for WSN	**Textbook 1**
33	15.		**Execute** the techniques involved in protocol programming	Techniques for protocol programming	**Textbook 1**
Lecture No.	**CLO**	**Unit**	**Learning Objective**	**Topics to be covered**	**Reference**
II SPELL					
34	16.	IV	**Define** cooperating objects	Introduction to the concept of cooperating objects	**Textbook 1**
35-37	17.		**Apply** the concept of cooperating objects in sensor network	Application in sensor networks	**Textbook 1**
38-40	18.		**Execute** the application of sensor network in embedded system	Combined application of embedded WSN	**Textbook 1**
41-43	19.		**Understand** the various architectures of wireless sensor network	System architectures	**Textbook 1**
44	20.		**Formulate** the programming models of wireless sensor network	Programming models	**Textbook 1**
45	21.	V	**Use** wireless sensor network for environmental monitoring	Wireless sensor networks for environmental monitoring	**Textbook 1**
46-48	22.		**Implement** wireless sensor network using mobile nodes	Wireless sensor network with mobile nodes	**Textbook 1**
49-51	23.		**Interpret** sensor network for surveillance monitoring	Autonomous robotic teams for surveillance monitoring	**Textbook 1**
52-55	24.		**Execute** sensor network for inter-vehicle communication	Inter-vehicle communication	**Textbook 1**

XI. MAPPING OF COURSE OBJECTIVES LEADING TO THE ACHIEVEMENT OF 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				H		S	S
II		S					S			S			H	S	
III				H				S			S		H	S	
IV			H		S							H	H	S	

S – Supportive **H - Highly Related**

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

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	H		H					S			S	H		S	S
2	H				S		S				S		H	S	
3		S			S			S				H	H	S	
4	H			H			S	S		S	S			S	
5	H	S	H		S								H	S	

S – Supportive **H - Highly Related**

Prepared by **:**Ms Shreya Verma, Assistant Professor, ECE

Date **:**7th FEB,2018

HOD, ECE