# INSTITUTE OF AERONAUTICAL ENGINEERING

(AUTONOMOUS)

Dundigal, Hyderabad - 500 043

## ELECTRONICS AND COMMUNICATION ENGINEERING

## COURSE DESCRIPTION FORM

| | | | | |
|---|---|---|---|---|
| **Course Title** | **EMBEDDED SYSTEM ARCHITECTURE** | | | |
| **Course Code** | **BES004** | | | |
| **Regulation** | **R16 -AUTONOMOUS** | | | |
| **Course Structure** | Lectures | Tutorials | Practical's | Credits |
| | 3 | - | - | 3 |
| **Course Coordinator** | ECE | | | |
| **Team of Instructors** | Ms. Anitha.P,AssistantProfessor, ECE | | | |

## I. COURSE OVERVIEW:

This course starts by introducing some basic ideas of embedded systems design paradigms, architectures. Subsequently the course covers important concepts like interpret possibilities and challenges, both with respect to software and hardware. In later units analysis of a system both as whole and in the included parts, to understand how these parts interact in the functionality and properties of the system.

## II. PREREQUISITE(S):

| Level | Credits | Periods/ Week | Prerequisites |
|---|---|---|---|
| PG | 3 | 3 | Embedded System & Architecture |

## III. MARKS DISTRIBUTION:

| Sessional Marks | University End Exam Marks | Total Marks |
|---|---|---|

| | | |
|---|---|---|
| **Midterm Test**<br>There shall be two midterm examinations. Each midterm examination consists of essay paper and assignment.<br>The essay paper is for 25 marks of 120 minutes duration and shall contain 4 questions. The student has to answer 2 questions, each carrying 5 marks.<br>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.<br>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:**

I. Understanding of fundamental embedded systems design paradigms, architectures. II. Interpret possibilities and challenges, both with respect to software and hardware.

III. Analyze a system both as whole and in the included parts, to understand how these parts interact in the functionality and properties of the system.

## VI. COURSE OUTCOMES:

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

1. Understanding the basic concepts of embedded system.
2. Analysis of processor hardware.
3. Interpretation of memory management.
4. Application of software in embedded system.
5. Designing of models.

## 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:

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**UNIT -I:**

**INTRODUCTION TO EMBEDDED SYSTEMS: -**Embedded system model, embedded standards, block diagrams, powering the hardware: Embedded board using von Neuman model.

**EMBEDDED PROCESSORS:** ISA architecture models, application specific ISA models and general-purpose ISA models: Instruction level parallelism.

**UNIT-II:**

**PROCESSOR HARDWARE: -** Internal processor design: ALU, registers, control unit, clock, on chip memory, processor i/o, interrupts, processor buses, processor performance.

**UNIT-III:**

**SUPPORT HARDWARE: -**Board memory: ROM, RAM, cache, auxiliary memory, memory management, memory performance, board buses: Arbitration and timing, PCI bus example, integrating bus with components, bus performance.

**UNIT-IV**:

SOFTWARE: -Middleware and applications: PPP, IP middleware UDP, Java. Application layer: FTP client, SMTP, HTTP server and client.

**UNIT-V:**

**ENGINEERING ISSUES OF SOFTWARE: -** Design and development: architectural patterns and reference models: Creating the architectural structures, documenting the architecture, analyzing and evaluating the architecture, debugging testing, and maintaining.

**TEXT BOOKS:**

1. Tammy Noergaard, "Embedded system architecture", Elsevier, 2006.

**REFERENCE BOOKS:**

1. Jean J. Labrosse, "Embedded Systems Building Blocks: Complete and Ready-To-Use Modules in C", the publisher Paul Temme, 2011.

## 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 |
|---|---|---|---|---|---|
| | | **Course Content Delivery --- Lecture Wise Break-up of Topics** | | | |
| | | | **I SPELL** | | |
| 1-3 | 1. | I | **Understand** the basic concept of embedded system and the various standards used | Introduction to embedded system, embedded system model, embedded standards | **Text book 1** |
| 4-5 | 2. | | **Analyzing** the block diagram and hardware introduction | Block Diagrams & Powering the Hardware | **Textbook 1** |
| 6 | 3. | | **Identify** the concept of neuman model and its implementation | Embedded board using von Neuman model | **Textbook1** |
| 7-10 | 4. | | **Application** of various ISA models and its architecture, getting acquainted with various instructions used | Application specific ISA models and general purpose ISA models, Instruction level parallelism | **Text book 1** |
| 11 | 5. | | **Define** the design of processor | Internal processor design | **Text book 1** |
| 12-15 | 6. | | **Discuss** the memory, registers used in embedded system | ALU, Registers, Control Unit, Clock, On chip memory | **Text book 1** |
| 16-17 | 7. | | **Understanding** the various interrupts and processor | processor i/o, interrupts | **Text book 1** |

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|---|---|---|---|---|---|
| 18 | 8. | II | **Analyzing** the performance of processor and buses | Processor buses and processor performance. | **Text book 1** |
| 19-20 | 9. | III | **Describe** the board memory and supporting hardware | Support Hardware Board memory: ROM, RAM, | **Text book 1** |
| 21-22 | 10. | | **Define** auxiliary memory and cache | cache , auxiliary memory | **Text book 1** |
| 23 | 11. | | **Understanding** memory management | memory management | **Text book 1** |
| 24 | 12. | III | **Analyze** the performance of memory | memory performance | **Text book 1** |
| 25-26 | 13. | | **Understanding** the concept of buses | Board buses: Arbitration and timing, PCI bus example | **Text book 1** |
| 27-29 | 14. | | **Analyze** the performance of bus and its components | Integrating bus with components, bus performance. | **Text book1** |
| **Course Content Delivery --- Lecture Wise Break-up of Topics** | | | | | |
| **II SPELL** | | | | | |
| 30-32 | 15. | IV | **Application** of middleware and software | Software Middleware and Application | **Text book 1** |
| 33 | 16. | | **Describe** concepts of PPP | PPP | |
| 34 | 7. | | **Understanding** the IP middleware | IP middleware | **Text book 1** |
| 35-36 | 18. | | **Analyzing** the concepts of UDP, JAVA | . UDP, Java | **Text book 1** |
| 37-40 | 19. | | **Describe** the various protocols used | Application layer: FTP client, SMTP, HTTP server and client | **Text book 1** |
| 41 | 20. | | **Understanding** various issues of softwares | Engineering issues of softwares | **Text book 1** |
| 42-45 | 21. | | **Formulate & Analyze** Architectural patterns | Design and development: architectural patterns | **Text book 1** |

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|---|---|---|---|---|---|
| 46-47 | 22. | **V** | **Extend** the concept of architectural structures and models | Creating the architectural structures,Reference models | **Text book 1** |
| 48 | 23. | | **Formulating** the architecture documentation | Documenting the architecture | **Text book 1** |
| 49-55 | 24. | | **Evaluate** various architectures and its maintenance | Analyzing and evaluating the architecture, debugging testing, and maintaining | **Text book 1** |

## XI. MAPPING OF COURSE OBJECTIVES LEADING TO THEACHEIVEMENT 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 | | | | H | | S | S |
| **II** | | S | | | | | S | | | S | | | H | S | |
| **III** | | | | H | | | | S | | | S | | 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 | |

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**Prepared by :** Ms. Anitha.P, Assistant Professor, ECE

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