**Description of Course CSE 316**

**PART A: General Information**

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| **1** | **Course Title** | : MICROPROCESSORS, MICROCONTROLLERS, AND EMBEDDED SYSTEMSSESSIONAL |
| **2** | **Type of Course** | : SESSIONAL |
| **3** | **Offered to** | : DEPARTMENT OF CSE |
| **4** | **Pre-requisite Course(s)** | : NONE |

**PART B: Course Details**

* **Course Content (As approved by the Academic Council)**

Sessional based on CSE 315 including assembly language programming and experiments using microprocessor/microcontroller.

* **Course Objectives**

The students are expected to:

* Understandand adapt Assembly language
* Implement hardware systems through interfacing different computing and memory components
* Design and develop digital systems with a microcontroller, sensors, and/or actuators
* **Knowledge required**

**Technical**

* System design and development

**Analytical**

* Logic design
* **Teacher(s):**

|  |  |  |
| --- | --- | --- |
| **Name:** | **Office/Room:** | **E-mail and Telephone: (optional)** |
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* **Course Outcomes (COs)**

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| --- | --- | --- | --- | --- | --- |
| **CO No.** | **CO Statement**  After undergoing this course, students should be able to: | **Corresponding PO(s)\*** | **Domains and Taxonomy level(s)\*\*** | **Delivery Method(s) and Activity(-ies)** | **Assessment Tool(s)** |
| CO1 | **Understand** and **apply** Assembly language | PO1 and PO2 | C3 | Lecture, Demonstration, and hands-on | Assignments and Quiz |
| CO2 | **Implement** hardware systems through interfacing different computing and memory components. | PO3 and PO4 | C3, A5 | Lecture, Demonstration, and hands-on | Assignments and Quiz |
| CO3 | **Design** and **develop** digital systems with a microcontroller, sensors, and/or actuators. | PO5 and PO6 | C6, P7 | Lecture, Demonstration, and hands-on | Projectand Quiz |

**\*Program Outcomes (POs)**

PO1: Engineering knowledge; PO2: Problem analysis; PO3: Design/development of solutions; PO4: Investigation; PO5: Modern tool usage; PO6: The engineer and society; PO7: Environment and sustainability; PO8: Ethics; PO9: Individual work and teamwork; PO10: Communication; PO11: Project management and finance; PO12: Life-long learning.

**\*\*Domains**

**C-Cognitive**: C1: Knowledge; C2: Comprehension; C3: Application; C4: Analysis; C5: Synthesis; C6: Evaluation

**A-Affective**: A1: Receiving; A2: Responding; A3: Valuing; A4: Organizing; A5: Characterizing

**P-Psychomotor**: P1: Perception; P2: Set; P3: Guided Response; P4: Mechanism; P5: Complex Overt Response; P6: Adaptation; P7: Organization

* **Mapping of Knowledge Profile, Complex Engineering Problem Solving and Complex Engineering Activities**

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| **COs** | **K1** | **K2** | **K3** | **K4** | **K5** | **K6** | **K7** | **K8** | **P1** | **P2** | **P3** | **P4** | **P5** | **P6** | **P7** | **A1** | **A2** | **A3** | **A4** | **A5** |
| CO1 |  | √ | √ | √ | √ | √ | √ |  | √ | √ | √ | √ |  |  |  | √ |  |  | √ |  |
| CO2 |  | √ | √ | √ | √ | √ | √ |  | √ | √ | √ | √ |  |  | √ | √ | √ |  |  |  |
| CO3 |  | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |  |  |  | √ | √ |  | √ |  | √ |

**K-Knowledge Profile:**

**K1:** A systematic, theory-based understanding of the natural sciences applicable to the discipline; **K2:** Conceptually based mathematics, numerical analysis, statistics and the formal aspects of computer and information science to support analysis and modeling applicable to the discipline; **K3:** A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline; **K4:** Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline; **K5:** Knowledge that supports engineering design in a practice area; **K6:** Knowledge of engineering practice (technology) in the practice areas in the engineering discipline; **K7:** Comprehension of the role of engineering in society and identified issues in engineering practice in the discipline: ethics and the engineer’s professional responsibility to public safety; the impacts of engineering activity; economic, social, cultural, environmental and sustainability; **K8:** Engagement with selected knowledge in the research literature of the discipline

**P-Range of Complex Engineering Problem Solving:**

**P1:** Cannot be resolved without in-depth engineering knowledge at the level of one or more of K3, K4, K5, K6 or K8 which allows a fundamentals-based, first principles analytical approach; **P2:** Involve wide-ranging or conflicting technical, engineering and other issues; **P3:** Have no obvious solution and require abstract thinking, originality in analysis to formulate suitable models; **P4:** Involve infrequently encountered issues; **P5:** Are outside problems encompassed by standards and codes of practice for professional engineering; **P6:** Involve diverse groups of stakeholders with widely varying needs; **P7:** Are high level problems including many component parts or sub-problems

**A-Range of Complex Engineering Activities:**

**A1:** Involve the use of diverse resources (and for this purpose resources include people, money, equipment, materials, information and technologies); **A2:** Require resolution of significant problems arising from interactions between wide-ranging or conflicting technical, engineering or other issues; **A3:** Involve creative use of engineering principles and research-based knowledge in novel ways; **A4:** Have significant consequences in a range of contexts, characterized by difficulty of prediction and mitigation; **A5:** Can extend beyond previous experiences by applying principles-based approaches

* **Weekly schedule:**

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| --- | --- |
| **Week** | **Topics** |
| Week 1 | Course Overview,  Introduction to Emu 8086 (Combined) |
| Week 2 | Lecture on assembly language – I (Combined),  Publishing Offline 1 |
| Week 3 | Offline 1 Evaluation  Lecture on assembly language – II (Combined)  Publishing Offline 2 |
| Week 4 | Reserve |
| Week 5 | Offline 2 Evaluation  Online on assembly language |
|  | **Break** |
| Week 6 | Introduction to ATmega32 Microcontroller (2 Lecture) |
| Week 7 | Experiment on ATmega32 Microcontroller: Basic I/O and Interrupt |
| Week 8 | Experiment on ATmega32 Microcontroller: Led Matrix |
| Week 9 | Project proposal submission (on microcontroller) (Group wise),  Viva |
| Week 10 | Experiment on ATmega32 Microcontroller: ADC + LCD Display |
| Week 11 | Introduction to Arduino (2 Lecture)  Project Update – 1 Demonstration |
| Week 12 | Experiment on Arduino |
| Week 13 | Quiz |
| Week 14 | Project Final Submission |

* **Assessment Strategy**
* Class Attendance: Class attendance will be recorded in every class.
* Assignments and Project: There will be six Assignments and one Term Project.
* Quiz Exam: A comprehensive Quiz exam will be held at the end of the semester.
* **Distribution of Marks (Tentative)**

Attendance: 05%

Assignments: 45%

Project: 30%

Quiz Exam: 20%

Total: 100%

* **Textbook/ Reference**
* Embedded Systems Architecture by Daniele Lacamera

<https://www.amazon.com/Embedded-Systems-Architecture-architectural-pragmatic/dp/1788832507/>

* Embedded Systems: Introduction to Arm® Cortex™-M Microcontrollers by Jonathan W Valvano

<https://www.amazon.com/Embedded-Systems-Introduction-CortexTM-M-Microcontrollers/dp/1477508996>

* Embedded Systems with ARM Cortex-M Microcontrollers by Yifeng Zhu

<https://web.eece.maine.edu/~zhu/book/>

* Edward A. Lee and Sanjit A. Seshia, Introduction to Embedded Systems, A CyberPhysical Systems Approach

<https://ptolemy.berkeley.edu/books/leeseshia/releases/LeeSeshia_DigitalV2_2.pdf>