



# INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad -500 043

## INFORMATION TECHNOLOGY

### COURSE DESCRIPTOR

|                   |  |           |         |            |         |
|-------------------|--|-----------|---------|------------|---------|
| Course Title      | MICROPROCESSORS INTERFACING AND APPLICATIONS |           |         |            |         |
| Course Code       | AEC023                                       |           |         |            |         |
| Programme         | B.Tech                                       |           |         |            |         |
| Semester          | VI   | IT        |         |            |         |
| Course Type       | Core   |           |         |            |         |
| Regulation        | IARE - R16                                   |           |         |            |         |
| Course Structure  | Theory                                       |           |         | Practical  |         |
|                   | Lectures                                     | Tutorials | Credits | Laboratory | Credits |
|                   | 3  | 1         | 4       | 3          | 2       |
| Chief Coordinator | Mrs. G Bhavana, Assistant Professor , ECE    |           |         |            |         |
| Course Faculty    | Mrs. G Bhavana, Assistant Professor , ECE    |           |         |            |         |

#### I. COURSE OVERVIEW:

The course will make them learn the basic theory of microprocessor and their applications in detail. Subsequently the course covers important concepts like how to write an assembly language programming. They will learn to write an assembly language programming for interfacing various I/O modules. They will learn to design different advance architectures to design a new communication interfaces.

#### II. COURSE PRE-REQUISITES:

| Level | Course Code | Semester | Prerequisites                          | Credits |
|-------|-------------|----------|--|---------|
| UG    | ACS004      | III      | Computer Organization and Architecture | 4       |
| UG    | AEC020      | III      | Digital Logic Design                   | 4       |

#### III. MARKS DISTRIBUTION:

| Subject                                      | SEE Examination | CIA Examination | Total Marks |
|--|-----------------|-----------------|-------------|
| Microprocessors Interfacing and Applications | 70 Marks        | 30 Marks        | 100         |

#### IV. DELIVERY / INSTRUCTIONAL METHODOLOGIES:

|   |                        |   |          |   |              |   |        |
|---|------------------------|---|----------|---|--------------|---|--------|
| ✓ | 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 weightage 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<sup>th</sup> and 16<sup>th</sup> 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 to 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                   | <b>Engineering knowledge:</b> Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.   | 3        | Quiz                    |
| PO 2                   | <b>Problem analysis:</b> Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences   | 2        | Assignments             |
| PO 4                   | <b>Conduct investigations of complex problems:</b> 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. | 2        | Seminars                |

**3 = High; 2 = Medium; 1 = Low**

## VII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

| Program Specific Outcomes (PSOs) |  | Strength | Proficiency assessed by  |
|----------------------------------|--|----------|--------------------------|
| PSO 1                            | <b>Professional Skills:</b> 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        | Seminars and Assignments |
| PSO 2                            | <b>Software Engineering Practices:</b> 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        | Quiz and Assignments     |
| PSO 3                            | <b>Successful Career and Entrepreneurship:</b> 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  | -        | -                        |

**3 = High; 2 = Medium; 1 = Low**

## VIII. COURSE OBJECTIVES (COs):

| The course should enable the students to: |   |
|---|---|
| I   | Understand the basic concepts of microprocessors and develop the architectures of 8085 and 8086.      |
| II  | Analyze and develop assembly language programming for 8086 microprocessor.                            |
| III                                       | Develop various interfacing modules by using assembly language programming.                           |
| IV  | Understand and know the basic concepts of advance micro processor architectures like 80386 and 80486. |

## IX. 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 |
|-----------|-------|--|-------------|---------------------|
| AEC023.01 | CLO 1 | Understand the internal Architecture of 8086 microprocessor and explain various modes of | PO 1        | 3                   |

|           |        |  |      |   |
|-----------|--------|--|------|---|
|           |        | operation of 8086.   |      |   |
| AEC023.02 | CLO 2  | Differentiate between 8085 and 8086 microprocessors architectures and its functionalities.                             | PO 1 | 3 |
| AEC023.03 | CLO 3  | Distinguish between RISC and CISC architecture based microprocessors.  | PO 1 | 3 |
| AEC023.04 | CLO 4  | Explain various addressing modes and instruction set present in 8086 microprocessor.                                   | PO 2 | 2 |
| AEC023.05 | CLO 5  | Ability to understand and apply the fundamentals of assembly level programming of microprocessors.                     | PO 2 | 2 |
| AEC023.06 | CLO 6  | Analyze and develop low level languages like ALP in 8086 Microprocessor systems for real time applications.            | PO 2 | 2 |
| AEC023.07 | CLO 7  | Describe in detail about the concept of interrupt, types of interrupts and ISR present in 8086 microprocessor.         | PO 2 | 2 |
| AEC023.08 | CLO 8  | Understand the concept of memory organization in processors which helps in various system designing aspects.           | PO 1 | 3 |
| AEC023.09 | CLO 9  | Identify the importance and significance of serial communication protocols in 8086 microprocessor.                     | PO 1 | 3 |
| AEC023.10 | CLO 10 | Explain in detail about the importance of interrupt and interrupt sub routines in 8086 microprocessor.                 | PO 2 | 2 |
| AEC023.11 | CLO 11 | Discuss the interfacing diagram of I/O devices with keyboard, 7-segment display, LCD and DAC to ADC.                   | PO 4 | 1 |
| AEC023.12 | CLO 12 | Develop and design the interfacing circuit diagram of 8251 with 8086 processor.  | PO 1 | 3 |
| AEC023.13 | CLO 13 | Analyze and understand various synchronous and asynchronous serial data transfer schemes in 8086.                      | PO 1 | 3 |
| AEC023.14 | CLO 14 | Explain the advance architectures of PIC and also the importance of interfacing a interrupt controller in PIC.         | PO 1 | 3 |
| AEC023.15 | CLO 15 | Understand basic architecture of 16 bit and 32 bit microprocessors with the help of multitasking and addressing modes. | PO 2 | 2 |
| AEC023.15 | CLO 16 | Analyze the various advanced microprocessors internal architectures for 80X86 by paging and technical features.        | PO 1 | 2 |

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**X. MAPPING COURSE LEARNING OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:**

| Course Learning Outcomes (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                           | 2                      |     |     |     |     |     |     |     |     |      |      |      | 2                                | 2    |      |
| CLO 2                           | 3                      |     |     |     |     |     |     |     |     |      |      |      | 1                                |      |      |

|        |   |   |  |   |  |  |  |  |  |  |  |  |   |   |  |
|--------|---|---|--|---|--|--|--|--|--|--|--|--|---|---|--|
| CLO 3  |   |   |  |   |  |  |  |  |  |  |  |  | 3 |   |  |
| CLO 4  |   | 2 |  |   |  |  |  |  |  |  |  |  | 1 |   |  |
| CLO 5  |   | 2 |  |   |  |  |  |  |  |  |  |  |   |   |  |
| CLO 6  |   | 3 |  |   |  |  |  |  |  |  |  |  |   | 3 |  |
| CLO 7  |   | 2 |  |   |  |  |  |  |  |  |  |  |   | 2 |  |
| CLO 8  | 3 |   |  |   |  |  |  |  |  |  |  |  | 2 |   |  |
| CLO 9  | 2 |   |  |   |  |  |  |  |  |  |  |  |   | 2 |  |
| CLO 10 |   | 2 |  |   |  |  |  |  |  |  |  |  |   |   |  |
| CLO 11 |   |   |  | 2 |  |  |  |  |  |  |  |  |   |   |  |
| CLO 12 | 3 |   |  |   |  |  |  |  |  |  |  |  |   |   |  |
| CLO 13 | 2 |   |  |   |  |  |  |  |  |  |  |  | 1 |   |  |
| CLO 14 | 3 |   |  |   |  |  |  |  |  |  |  |  |   |   |  |
| CLO 15 |   | 2 |  |   |  |  |  |  |  |  |  |  | 2 | 2 |  |
| CLO 16 |   | 2 |  |   |  |  |  |  |  |  |  |  | 1 |   |  |

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#### **XI. ASSESSMENT METHODOLOGIES – DIRECT**

|                      |      |              |      |              |      |               |      |
|----------------------|------|--------------|------|--------------|------|---------------|------|
| CIE Exams            | PO 1 | SEE Exams    | PO 1 | Assignments  | PO 2 | Seminars      | PO 4 |
| Laboratory Practices | -    | Student Viva | -    | Mini Project | -    | Certification | -    |
| Term Paper           | PO 4 |              |      |              |      |               |      |

#### **XII. ASSESSMENT METHODOLOGIES - INDIRECT**

|   |  |   |                           |
|---|--|---|---------------------------|
| ✓ | Early Semester Feedback                | ✓ | End Semester OBE Feedback |
| ✗ | Assessment of Mini Projects by Experts |   |                           |

#### **XIII. SYLLABUS**

|  |   |
|--|---|
| <b>Unit-I</b>  | <b>OVERVIEW OF 8086 MICROPROCESSOR</b>    |
| Introduction to 8085 microprocessor. RISC and CISC processors, architecture of 8086 microprocessor, special functions of general purpose register, 8086 flag register and function of 8086 flags, addressing modes of 8086, instruction set of 8086, assembler directives. |   |
| <b>Unit-II</b>   | <b>8086 ASSEMBLY LANGUAGE PROGRAMMING</b> |
| Minimum mode and maximum mode of operation, timing diagram, Assembly language programs: Assembly language programs involving logical, branch and call instructions, sorting, evaluation of arithmetic expressions, string manipulation.                                    |   |

|   |   |
|---|---|
| <b>Unit-III</b>   | <b>8255 PROGRAMMABLE PERIPHERAL INTERFACE (PPI)</b> |
| Various modes of 8255 operation and interfacing to 8086; Interfacing keyboard, displays, 8279 Stepper motor and actuators, digital to analog and analog to digital converter interfacing.<br>Interrupt structure of 8086: Interrupt structure of 8086, Vector interrupt table, interrupt service routines; Introduction to DOS and BIOS interrupts, 8259 PIC architecture and interfacing cascading of interrupt controller and its importance. |   |
| <b>Unit-IV</b>  | <b>SERIAL DATA TRANSFER SCHEMES</b>                 |
| Asynchronous and synchronous data transfer schemes, 8251 USART architecture and interfacing; TTL to RS 232C and RS232C to TTL conversion; Sample program of serial data transfer; Introduction to high-speed serial communications standards, USB.  |   |
| <b>Unit-V</b>   | <b>ADVANCED MICROPROCESSORS:</b>                    |
| 80286 Microprocessor: Architecture, registers (Real/Protected mode), privilege levels, descriptor cache, memory access in GDT and LDT, multitasking, addressing modes; Flag register 80386: Architecture, register organization, memory access in protected mode, paging; 80486: Only the technical features.   |   |
| <b>Text Books:</b>  |   |
| <ol style="list-style-type: none"> <li>1. D. V. Hall, "Microprocessors and Interfacing", Tata McGraw-Hill Education, 3rd Edition 2013.</li> <li>2. A.K Ray, K. M. Bhurchandani, "Advanced Microprocessors and Peripherals" Tata McGraw-Hill Education, 2nd Edition, 2006.</li> <li>3. Savaliya M. T, "8086 Programming and Advance Processor Architecture", Wiley India Pvt., 1st Edition, 2012.</li> </ol>                                     |   |
| <b>Reference Books:</b>   |   |
| <ol style="list-style-type: none"> <li>1. N. Senthil Kumar, M. Saravanan, S. Jeevanathan, S. K. Shah, "Microprocessors and Interfacing", Oxford University, 1st Edition, 2012.</li> <li>2. Lyla B. Das, "The x86 Microprocessors", Pearson India, 2nd Edition, 2014.</li> </ol>   |   |

#### XIV. COURSE PLAN:

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

| <b>Lecture No</b> | <b>Topics to be covered</b>   | <b>Course Learning Outcomes (CLOs)</b> | <b>Reference</b> |
|-------------------|---|--|------------------|
| 1-5               | Basic understanding of 8085 and 8086 microprocessors architectures and its functionalities.                                   | CLO 1                                  | T2:1.2           |
| 6-10              | Able to understand the importance of addressing modes and the instruction set of the processor which is used for programming. | CLO 4                                  | T2:2.2           |
| 11-15             | Analyze the importance of the instruction set of the processor which is used for programming.                                 | CLO 4                                  | T2:2.3           |
| 16-20             | Discuss about the assembly language programming and of 8086 microprocessor.   | CLO 5                                  | T2:3.2           |
| 21-25             | Understand the internal Architecture and different modes of operation of popular 8086 microprocessors.                        | CLO 2                                  | T2:5.5           |
| 26-28             | Ability to understand and apply the fundamentals of assembly level programming of microprocessors.                            | CLO 6                                  | T2:3.3           |
| 29-30             | Explain sorting and evaluation concepts of 8086 microprocessor.   | CLO 12                                 | T2:2.2           |
| 31-35             | Ability to interface the external peripherals and I/O devices and program the 8086 microprocessor using 8255.                 | CLO 14                                 | T2:5.1           |
| 36-40             | Understand the concepts of interrupt and interrupt sub routines in 8086 microprocessor.                                       | CLO 10                                 | T2:4.3           |
| 41-44             | Identify the significance of serial communication in 8086. Develop the interfacing of 8251 with 8086 processor.               | CLO 13                                 | T2:6.1           |
| 45-52             | Analyze and understand the Interfacing of RS-232C and high speed buses.   | CLO 15                                 | R2:5.1           |

| <b>Lecture No</b> | <b>Topics to be covered</b>   | <b>Course Learning Outcomes (CLOs)</b> | <b>Reference</b> |
|-------------------|---|--|------------------|
| 53-58             | Understand and analyze the various advanced microprocessors internal architectures such as 80X86. | CLO 16                                 | R2:5.3           |

**XV. GAPS IN THE SYLLABUS - TO MEET INDUSTRY / PROFESSION REQUIREMENTS:**

| <b>S. N0</b> | <b>Description</b>   | <b>Proposed actions</b>      | <b>Relevance with POs</b> | <b>Relevance with PSOs</b> |
|--------------|--|------------------------------|---------------------------|----------------------------|
| 1            | ALP for Microprocessors like 8086 and 80x86                | Seminars / NPTEL/Assignments | PO 1, PO 2                | PSO 1                      |
| 2            | Interfacing IO devices to various types of Microprocessors | Seminars / NPTEL             | PO 2, PO 4                | PSO 1                      |
| 3            | Programming of all microprocessors by using ALP            | Guest Lectures               | PO 1, PO 2                | PSO 2                      |

**Prepared by:**

Mrs. G Bhavana, Assistant Professor.

**HOD, IT**