INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad -500 043

ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE DESCRIPTOR

Course Title	**MICROCONTROLLER AND DIGITAL SIGNAL PROCESSING LABORATORY**					
Course Code	**AEC022**					
Programme	B.Tech					
Semester	VI	EEE				
Course Type	Core					
Regulation	IARE - R16					
Course Structure	**Theory**			**Practical**		
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**	
	3	1	4	3	2	
Chief Coordinator	Ms.J. Sravana, Assistant Professor, ECE					
Course Faculty	Ms.J. Sravana, Assistant Professor, ECE					

I. COURSE OVERVIEW:

The aim of this course is to conduct experiments on microprocessor and microcontrollers and interfacing 8051 microcontrollers to lcd, keyboard. This course is also useful for learning basic signals by using mat lab software.

II. COURSE PRE-REQUISITES:

Level	Course code	Semester	Prerequisites	Credits
UG	AEC001	III	Electronic Devices and Circuits	4
UG	AEC019	IV	Digital and Pulse Circuits	4
UG	AEC008	V	Integrated Circuits Applications	4

III. MARKS DISTRIBUTION:

Subject	SEE Examination	CIA Examination	Total marks
MICROCONTROLLER AND DIGITAL SIGNAL PROCESSING LABORATORY	70 Marks	30 Marks	100

IV. DELIVERY / INSTRUCTIONAL METHODOLOGIES:

X	Chalk & talk	X	Quiz	X	Assignments	X	MOOCs
√	LCD / PPT	X	Seminars	X	Mini project	√	Videos
√	Open ended experiments						

V. EVALUATION METHODOLOGY:

Each laboratory will be evaluated for a total of 100 marks consisting of 30 marks for internal assessment and 70 marks for semester end lab examination. Out of 30 marks of internal assessment, continuous lab assessment will be done for 20 marks for the day to day performance and 10 marks for the final internal lab assessment.

Semester End Examination (SEE): The semester end lab examination for 70 marks shall be conducted by two examiners, one of them being Internal Examiner and the other being External Examiner, both nominated by the Principal from the panel of experts recommended by Chairman, BOS.

The emphasis on the experiments is broadly based on the following criteria:

20 %	To test the preparedness for the experiment.
20 %	To test the performance in the laboratory.
20 %	To test the calculations and graphs related to the concern experiment.
20 %	To test the results and the error analysis of the experiment.
20 %	To test the subject knowledge through viva – voce.

Continuous Internal Assessment (CIA):
CIA is conducted for a total of 30 marks (Table 1), with 20 marks for continuous lab assessment during day to day performance, 10 marks for final internal lab assessment.

Table 1: Assessment pattern for CIA

Component	**Laboratory**		**Total Marks**
Type of Assessment	Day to day performance	Final internal lab assessment	
CIA Marks	20	10	30

Continuous Internal Examination (CIE):
One CIE exams shall be conducted at the end of the 16th week of the semester. The CIE exam is conducted for 10 marks of 3 hours duration.

Preparation	**Performance**	**Calculations and Graph**	**Results and Error Analysis**	**Viva**	**Total**
2	2	2	2	2	10

VI. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes		**Strength**	**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.	2	Calculations of the observations
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.	2	Characteristic curves

Program Outcomes		Strength	Proficiency assessed by
PO3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	3	Seminar
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.	2	Conducting experiments
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.	3	Characteristic curves

3= High; 2 = Medium; 1 = Low

VII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes		Strength	Proficiency assessed by
PSO1	**Problem Solving Skills:** Exploit the knowledge of high voltage engineering in collaboration with power systems in innovative, dynamic and challenging environment, for the research based team work.	-	-
PSO2	**Professional Skills:** Identify the scientific theories, ideas, methodologies and the new cutting edge technologies in renewable energy engineering, and use this erudition in their professional development and gain sufficient competence to solve the current and future energy problems universally.	2	Term observations
PSO3	**Modern Tools in Electrical Engineering** To be able to utilize of technologies like PLC, PMC, process controllers, transducers and HMI and design, install, test , maintain power systems and industrial applications.	-	-

3= High; 2 = Medium; 1 = Low

VIII. COURSE OBJECTIVES :

The course should enable the students to:	
I	Develop ALP for arithmetic and logical operations using 8051
II	Implement convolution using MATLAB
III	Implement digital signal processing algorithms using MATLAB

IX. COURSE OUTCOMES (COs):

COs	Course Outcome	CLOs	Course Learning Outcome
CO 1	Apply a basic concept of digital fundamentals to Microprocessor based personal computer system	CLO 1	Understand and Describe the evolution and basic architecture of 8086
		CLO 2	Discuss the segmentation and programming model and List out the register organization
		CLO 3	Understand the difference between microprocessors and microcontrollers
CO 2	Describe the architecture and instruction set of 8051 microcontroller	CLO 4	Understand and describe input/output ports of 8051 and register organization

COs	Course Outcome	CLOs	Course Learning Outcome
		CLO 5	Describe different types of memory like special function register for program memory and data memory
		CLO 6	Discuss the addressing modes of 8051 microcontroller
		CLO 7	Discuss the instruction set of 8051 microcontroller
		CLO 8	Develop assembly language program for 8051 based operations.
CO 3	Describe the architecture and instruction set of 8051 microcontroller Design and implement 8051 microcontroller based systems.	CLO 9	Discuss and illustrate the Timers/counters, serial communication
		CLO10	Understand and discuss external memory
CO 4	Analyze the fundamentals and concepts in assess the effect of LTI systems on signals passing through them in frequency and time domains	CLO 11	Understand the frequency domain representation and discrete Fourier transforms
CO 5	Discriminate the Fourier, Laplace and Z-transforms as appropriate for various signals and systems	CLO 12	Understand the FFT and FFT algorithms, inverse FFT and FFT with general radix- N.
		CLO 13	Analyze and design of FIR digital filters
		CLO 14	Analyze and design of IIR filters and digital filters using window techniques

X. COURSE LEARNING OUTCOMES:

CLO Code	CLO's	At the end of the course, the student will have the ability to:	PO's mapped	Strength of mapping
AEC022.01	CLO 1	Design and develop an assembly language program using 8086 microprocessor and to show the following aspects, programming execution debugging to demonstrate the tool chain for WIN862 and hardware for 8086 microprocessor.	PO3, PO4	2
AEC022.02	CLO 2	a)Write an ALP program to perform 8 Bit arithmetic operations using 8051 b)Write an ALP program to perform 16 Bit arithmetic operations using 8051	PO3, PO4	2
AEC022.03	CLO 3	a)write an ALP program to count the number of ones in any number b)Write an ALP program to count the number of zeros in any number	PO2, PO4	3

AEC022.04	CLO 4	Write an ALP program and verify timer/counter in 8051	PO1, PO3	3
AEC022.05	CLO 5	Write an ALP program to operate UARE in 8051.	PO3, PO4	2
AEC022.06	CLO 6	Write an ALP program to interface 8051 and keyboard	PO1, PO2	3
AEC022.07	CLO 7	a)write an ALP program to convert analog signal to digital signal using 8051 b)write an ALP program to convert digital signal to analog signal using 8051	PO2, PO4	2
AEC022.08	CLO 8	a)Generation of linear convolution without using built in function in MATLAB b)Generation of circular convolution without using built in function in MATLAB	PO2, PO4	2
AEC022.09	CLO 9	Compute the Discrete Fourier Transform and IDFT with and without fft and ifft in MATLAB	PO3, PO4, PO5	3
AEC022.10	CLO 10	Determination of power spectrum of a given sequence.	PO3, PO4, PO5	3
AEC022.11	CLO 11	Implementation of Decimation-in-time radix-2 FFT algorithm	PO3, PO5	3
AEC022.12	CLO 12	Implementation of Decimation-in-frequency radix-2 FFT algorithm	PO3, PO4, PO5	3
AEC022.13	CLO 13	Implementation of LP/HP IIR digital filter	PO3, PO5	3
AEC022.14	CLO 14	Implementation of LP/HP FIR digital filter	PO3, PO4, PO5	3

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XI. MAPPING COURSE LEARNING OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC 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											
CLO 2			2	2										2	
CLO 3		3		3											
CLO 4	3		3												
CLO 5			2	2										2	
CLO 6	3	3													
CLO 7		2		2										2	
CLO 8		2		2											
CLO 9			3	2	3									2	
CLO 10			2	3	3									3	
CLO 11			3		3										
CLO 12			3	2	3									2	
CLO 13			2		3										
CLO 14			3	2	3									2	
CLO 15	2														

CLOs	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CLO 16		2												2	

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XII. ASSESSMENT METHODOLOGIES – DIRECT:

CIE Exams	PO1 PO2 PO3 PO4 PO5	SEE Exams	PO1 PO2 PO3 PO4 PO5	Assignments	-	Seminars	-
Laboratory practices	PO1 PO2 PO3 PO4 PO5	Student viva	PO1 PO2 PO3 PO4 PO5	Mini project	-	Certification	-
Term paper	-						

XIII. ASSESSMENT METHODOLOGIES – INDIRECT:

✔	Early Semester Feedback	✔	End Semester OBE Feedback
✘	Assessment of Mini Projects by Experts		

XIV. SYLLABUS:

LIST OF EXPERIMENTS	
Week-1	**DESIGN A PROGRAM USING WIN862 AND 8086 MICROPROCESSOR**
Design and develop an assembly language program using 8086 microprocessor and to show the following aspects, programming execution debugging to demonstrate the tool chain for WIN862 and hardware for 8086 microprocessor.	
Week-2	**8 AND 16 BIT ARITHMETIC OPERATIONS**
a)Write an ALP program to perform 8 Bit arithmetic operations using 8051 b)Write an ALP program to perform 16 Bit arithmetic operations using 8051	
Week-3	**NUMBER OF ZEROS AND ONES IN ANY NUMBER**
a)write an ALP program to count the number of ones in any number b)Write an ALP program to count the number of zeros in any number	
Week-4	**TIMER / COUNTER IN 8051**
Write an ALP program and verify timer/counter in 8051	
Week-5	**UART OPERATION IN 8051**
Write an ALP program to operate UARE in 8051.	
Week-6	**INTERFACE SEVEN SEGMENT DISPLAY**
Write an ALP program to interface 8051 and keyboard	
Week-7	**ADC, DAC WITH 8051**
a)write an ALP program to convert analog signal to digital signal using 8051 b)write an ALP program to convert digital signal to analog signal using 8051	
Week-8	**CONVOLUTION**
a)Generation of linear convolution without using built in function in MATLAB b)Generation of circular convolution without using built in function in MATLAB	
Week-9	**DISCRETE FOURIER TRANSFORM**
Compute the Discrete Fourier Transform and IDFT with and without fft and ifft in MATLAB	
Week-10	**POWER SPECTRUM**
Determination of power spectrum of a given sequence.	

WeeK-11	**DIT - FAST FOURIER TRANSFROM**
Implementation of Decimation-in-time radix-2 FFT algorithm	
WeeK-12	**DIF - FAST FOURIER TRANSFROM**
Implementation of Decimation-in-frequency radix-2 FFT algorithm	
WeeK-13	**IIR FILTER**
Implementation of LP/HP IIR digital filter	
WeeK-14	**FIR FILTER**
Implementation of LP/HP FIR digital filter	

Text Books:

1. Kenneth.J.Ayala. The 8051 microcontroller, 3rd Edition, Cengage learning, 2010.
2. D V Hall, "Microprocessors and Interfacing", Tata McGraw-Hill Education, 3rd Edition 2013.
3. A K ray and K M Bhurchandani, "Advanced microprocessors and peripherals", Tata McGraw-Hill Education, 2nd Edition 2006

Reference Books:

1.Fundamentals of Digital signal processing - LoneyLudeman, John wiley, 2009.
2.Digital signal processing: fundamentals and applications - Li Tan Elsevier, 2008.

XV. COURSE PLAN:

The course plan is meant as a guideline. There may probably be changes.

Week No	Topics to be covered	Course Learning Outcomes (CLOs)	References
1	Design and develop an assembly language program using 8086 microprocessor and to show the following aspects, programming execution debugging to demonstrate the tool chain for WIN862 and hardware for 8086 microprocessor.	CLO 1	T2: 5.11
2	a)Write an ALP program to perform 8 Bit arithmetic operations using 8051 b)Write an ALP program to perform 16 Bit arithmetic operations using 8051	CLO 2	T2: 5.13
3	a)write an ALP program to count the number of ones in any number b)Write an ALP program to count the number of zeros in any number	CLO 3	T2: 5.14
4	Write an ALP program and verify timer/counter in 8051	CLO 4	T2: 5.20
5	Write an ALP program to operate UARE in 8051.	CLO 5	T2: 6.11
6	Write an ALP program to interface 8051 and keyboard	CLO 6	T2: 5.19
7	a)write an ALP program to convert analog signal to digital signal using 8051 b)write an ALP program to convert digital signal to analog signal using 8051	CLO 7	T2: 5.12
8	a)Generation of linear convolution without using built in function in MATLAB b)Generation of circular convolution without using built in function in MATLAB	CLO 8	T2: 7.3.2
9	Compute the Discrete Fourier Transform and IDFT with and without fft and ifft in MATLAB	CLO 9	T2: 6.12
10	Determination of power spectrum of a given sequence.	CLO 10	T2: 6.15
11	Implementation of Decimation-in-time radix-2 FFT algorithm	CLO 11	T2: 7.16

12	Implementation of Decimation-in-frequency radix-2 FFT algorithm	CLO 12	T2: 7.18
13	Implementation of LP/HP IIR digital filter	CLO 13	T2: 8.19
14	Implementation of LP/HP FIR digital filter	CLO 14	T2: 8.19

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

S No	Description	Proposed actions	Relevance with POs	Relevance with PSOs
1	Signals on IIR and FIR filters MATLAB	NPTEL videos	PO5	PSO2
2	Interfacing of 8051 using keil software	NPTEL videos	PO5	PSO2

Prepared by:
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