

SKIT	Teaching Process	Rev No.: 1.0
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Note : Remove "Table of Content" before including in CP Book

# 18CSL48 : MICROCONTROLLER AND EMBEDDED SYSTEMS LAB

### A. LABORATORY INFORMATION

#### 1. Lab Overview

Degree:	BE	Program:	CS
Year / Semester :	2/4	Academic Year:	2018-19
CourseTitle:	Microcontroller and Embedded Systems lab	Course Code:	18CSL48
Credit / L-T-P:	2 / 1-0-2	SEE Duration:	180 Minutes
Total Contact Hours:	40 Hrs	SEE Marks:	60Marks
CIA Marks:	40	Assignment	1 / Module
Course Plan Author:	Prof. VINAY KUMAR B C	Sign	Dt :
Checked By:		Sign	Dt :

#### 2. Lab Content

EXPT	Title of the Experiments	Lab Hours	Concept	Blooms Level
1	Write a program to multiply two 16 bit binary numbers.	03	ALP	L4 Analyze
2	Write a program to find the sum of first 10 integer numbers.	03	ALP	L4 Analyze
3	Write a program to find factorial of a number.	03	ALP	L4 Analyze
	Write a program to add an array of 16 bit numbers and store the 32 bit result in internal RAM	03	ALP	L4 Analyze
5	Write a program to add an array of 16 bit numbers and store the 32 bit result in internal RAM	03	Interrupt Functions	L4 Analyze
	Write a program to find the largest/smallest number in an array of 32 numbers	03	ARM ALP &C	L4 Analyze
_	Write a program to arrange a series of 32 bit numbers in ascending/descending order			
8	Write a program to count the number of ones and zeros in two consecutive memory locations			
	To write and simulate C Programs for ARM microprocessor using KEIL (Demonstrate with the help of a suitable program)	03	ARM ALP &C	L4 Analyze
9	Display "Hello World" message using Internal UART	03	I/O Interfacing	L4 Analyze
	Interface and Control a DC Motor Interface a Stepper motor and rotate it in clockwise and anti- clockwise direction.	03	I/O Interfacing	L4 Analyze
11	Determine Digital output for a given Analog input using Internal ADC of ARM controller. Interface a DAC and generate Triangular and Square waveforms.	03	/O Interfacing	L4 Analyze
12	Interface a 4x4 keyboard and display the key code on an LCD	03	/O Interfacing	L4 Analyze
13	Interface a 4x4 keyboard and display the key code on an LCD On/ Off.	03	ARM Interface	L4 Analyze
14	Display the Hex digits 0 to F on a 7-segment LED interface, with an appropriate delay in between	03	ARM Interface	L4 Analyze

#### 3. Lab Material

Unit	Details	Available
1	Text books	
		In Lib

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2	Refere	nce books		
				In dept
3	Others	(Web, Video	, Simulation, Notes etc.)	
				Not Available

#### 4. Lab Prerequisites:

-	-	Base Course:		-	-
SNo	Course Code	Course Name	Topic / Description	Sem	Remarks
1	18CSL48	Microcontroller and Embedded System Lab		2	
				2	

Note: If prerequisites are not taught earlier, GAP in curriculum needs to be addressed. Include in Remarks and implement in B.5.

#### 5. General Instructions

SNo	Instructions	Remarks
1	Observation book and Lab record are compulsory.	
2	Students should report to the concerned lab as per the time table.	
	After completion of the program, certification of the concerned staff in- charge in the observation book is necessary.	
	Student should bring a notebook of 100 pages and should enter the readings /observations into the notebook while performing the experiment.	
	The record of observations along with the detailed experimental procedure of the experiment in the Immediate last session should be submitted and certified staff member in-charge.	
6	Should attempt all problems / assignments given in the list session wise.	
	It is responsibility to create a separate directory to store all the programs, so that nobody else can read or copy.	
	When the experiment is completed, should disconnect the setup made by them, and should return all the components/instruments taken for the purpose.	
	Any damage of the equipment or burn-out components will be viewed seriously either by putting penalty or by dismissing the total group of students from the lab for the semester/year	
	Completed lab assignments should be submitted in the form of a Lab Record in which you have to write the algorithm, program code along with comments and output for various inputs given	

#### 6. Lab Specific Instructions

SNo	Specific Instructions/Software Programs 8086	Remarks
1	Open DOS editor to create file	
2	Use KEIL tool to Assemble , debug and execute file	
	Specific Instructions/Software Programs ARM	

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1	Use KEIL tool to Assemble , debug and execute file	
	Specific Instructions/Hardware Programs 8086	
1	Open DOS editor to create file	
2	Use KEIL tool to Assemble , debug and execute file	
3	Do connections as per interface diagram	
4	Test results	
	Specific Instructions/Hardware Programs ARM	
1	Use KEIL tool to Assemble , debug and execute file	
2	Do connections as per interface diagram	
3	Test results	

### B. OBE PARAMETERS

### 1. Lab / Course Outcomes

#	COs	Teach.	Concept	Instr	Assessment	Blooms'
		Hours		Method	Method	Level
1	Develop and test program using	24	ALP	Instructi	Slip Test	L2
	ARM7TDMI/LPC2148			ons		
				&Demo		
				nstratio		
				n		
2	Conduct the following experiments on an	16	INTERFACIN	Instructi	Slip Test	L3
	ARM7TDMI/LPC2148 evaluation board		G	ons		
	using evaluation version of Embedded 'C'			&Demo		
	& Keil Uvision-4 tool/compiler			nstratio		
				n		
-	Total	39	-	-	-	-

Note: Identify a max of 2 Concepts per unit. Write 1 CO per concept.

### 2. Lab Applications

SNo	Application Area	CO	Level
1	Assembly language programming is required to develop system programs	CO1	L2
2	Interrupt Functions is required to formulate system program solutions	CO1	L2
3	ARM AL and 'C' programming is required to develop embedded systems.	CO2	L3
4	ARM programming for interfacing external devices is used design and develop	CO2	L3
	embedded systems.		

Note: Write 1 or 2 applications per CO.

### 3. Articulation Matrix

#### (CO – PO MAPPING)

-	Course Outcomes				Ρ	rogr	am (	Dutc	ome	s				
#	COs	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	Level
		1	2	3	4	5	6	7	8	9	10	11	12	
	Develop and test program using ARM7TDMI/LPC2148	3	2	3		3								2
	Conduct the following experiments on an ARM7TDMI/LPC2148 evaluation board using evaluation version of Embedded 'C' & Keil Uvision- 4 tool/compiler.		2	3		3						2	2	3

Note: Mention the mapping strength as 1, 2, or 3

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Маррі	ng	Mapping	Justification
		Level	
CO	PO	-	-
CO1	PO1		Knowledge of assembly language programming is required to develop system programs
CO1	PO2		Knowledge of assembly language programming is useful in analyzing system programs
CO1	PO3	3	Assembly language programs used to design and develop system programs
CO1	PO5	3	Assembler tool used to learn Assembly language programming
CO2	PO1	3	Knowledge of Interrupt Functions is required to develop system programs
CO2	PO2	2	Interrupt Functions is required to formulate system program solutions
CO2	PO3	3	Interrupt Functions are used to design and develop system programs
CO2	PO5	3	Interrupt Functions help in development of system program projects
CO2	PO11	2	Learning in the context of technology changes
CO2	PO12	3	ARM programming for interfacing external devices is used design and develop embedded systems.

Note: Write justification for each CO-PO mapping.

#### 5. Curricular Gap and Content

	•				
SNo	Gap Topic	Actions Planned	Schedule Planned	<b>Resources Person</b>	PO Mapping
1					
2					
3					
4					
5					

Note: Write Gap topics from A.4 and add others also.

#### 6. Content Beyond Syllabus

SNo	Gap Topic	Actions Planned	Schedule Planned	<b>Resources Person</b>	PO Mapping
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					

Note: Anything not covered above is included here.

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#### 1. Course Coverage

Unit	Title	Teachi		No		oction	n in Exa	m		СО	Levels
	Titte	ng						Asg-3	SEE		Levels
		Hours			017 3	rsg i	rsy z	nsg s	JLL		
1	ALP for 16 Bit addition	03	1	_	-	_	_	-	1	CO1	
2	ALP for first addition of ten		1	-	-	-	-	-	1	CO1	
	numbers										
	ALP for factorial number	03	1	-	-	-	-	-	1	CO1	
4	ALP for add an array of 16 bit	03	1		-	-	-	-	1	CO1	
	numbers										
5	ALP to square of a number (1 to	03	-	1	-	-	-	-	1	CO1	
	10) using look-up table. Write a program to count the										
	number of ones and zeros in two										
	consecutive memory locations										
6	largest/smallest number in an array	03	-	1	-	-	-	-	1	CO1	
	of 32 numbers										
	arrange a series of 32 bit numbers										
	in ascending/descending order										
7	ARM C programs	03	-	1	-	-	-	-	1	CO2	
8	Display "Hello World" message	03	-	1		-	-	-	1	CO2	
	using Internal UART.										
9	Determine Digital output for a given	03	-	-	1	-	-	-	1	CO2	
	Analog input using Internal ADC of										
	ARM controller										
10	interface stepper motor	03	-	-	1	-	-	-	1	CO2	
	Interface and Control a DC Motor										
11	ALP to interface DAC	03	-	-	1	-	-	-	1	CO2	
	Display the Hex digits 0 to F on a 7-										
	segment LED interface, with an										
	appropriate delay in between										
12	interface LCD on/off	03	-	-	1	-	-	-	1	CO2	
13	Interface a 4x4 keyboard and	03	-	-	1	-	-	-	1	CO2	
	display the key code on an LCD										
-	Total	39	4	4	5				13	-	
NILL	Write CO based on the theory cou										

Note: Write CO based on the theory course.

#### 2. Continuous Internal Assessment (CIA)

Evaluation	Weightage in Marks	CO	Levels
CIA Exam – 1	25	CO1	L2
CIA Exam – 2	25	CO1	L2
CIA Exam – 3	25	CO1,CO2	L3
record	15		
Final CIA Marks	40	-	-

-		· · · · · · · · · · · · · · · · · · ·
SNo	Description	Marks
1	Observation and Weekly Laboratory Activities	05 Marks
2	Record Writing	10 Marks for each Expt
3	Internal Exam Assessment	25 Marks

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4	Interna	al Assessmer	t	40 Marks
5	SEE			60 Marks
-	Total			100 Marks

### D. EXPERIMENTS

### Experiment 01 :

-	Experiment No.:	1 Marks		Date Planned	Date Conducted				
1	Title	ALP for 16 Bit	LP for 16 Bit addition						
			ble to develop ARM Assembly language program for addition						
	Aim		im to multiply t		nary numbers.				
	Material / Equipment Required	1. Designing to	ol software KE	IL					
	Theory, Formula, Principle, Concept								
	Procedure, Program, Activity, Algorithm, Pseudo Code1	ENTRY LDR R( LDRH F LDRH R MUL R: STOP B STOP		address of mu irst number l Second numt = R1 x R2					
	Block, Circuit, Model Diagram, Reaction Equation, Expected Graph								
	Observation Table, Look-up Table, Output								
9	Sample Calculations								
10	Graphs, Outputs								

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		Register	Value	-
		■       Current         ■       R0         ■       R1         ■       R2         ■       R3         ■       R4         ■       R5         ■       R6         ■       R7         ■       R8         ■       R9         ■       R10         ■       R11         ■       R12         ■       R13 (SP)         ■       R14 (LR)         ■       R15 (PC)         ■       CPSR         ■       SPSR         ■       User/System         ■       Fast Interrupt         ■       Interrupt         ■       Interrupt         ■       Undefined	0x0000010 0x00001222 0x00001133 0x0137DEC6 0x0000000 0x0000000 0x0000000 0x0000000	
11	Results &Analysis			
	Application Areas	Assembly language program	ming is required to dev	elop system program
13	Remarks			
	- aculty Signature with			

# Experiment 02 :

-	Experiment No.:	2	Marks		Date Planned		ate ducted	
1	Title	first a	ddition of te	n numbers		1.000		
2	Course Outcomes	Able t	o develop A	RM Assemb	ly language p	programfor additic	on first te	en numbers
3	Aim <b>1.</b>	Write	e a progra	m to find th	ne sum of fi	rst 10 integer r	numbei	rs.
	Material / Equipment Required	desig	ning tool sc	ftware keil				
5	Theory, Formula, Principle, Concept	Able t	o develop A	RM Assemb	ly language p	program		
6	Procedure,	AREA	ADD1TO1	), CODE, REAL	DONLY ENTRY			
	Program, Activity,		MOV R	R1,#10	;len	gth of array		
	Algorithm, Pseudo Code		LDR R	2,=ARRAY	;Loa	d the starting ad	dress of	the array
			MOV R	84,#0	;Init	ial sum		
		NEX	KT LDR R	3,[R2],#4	;Loa	d first integer of	the	
			array in	R3 ADD R4	4,R4,R3 ;R4=	sum of integers		
			SUBS I	R1,R1,#1				
			BNE N	EXT				

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			;repeat until R1=0 ARRAY DCD 1,2,3,4, 5,6,7,8, 9,10 END	STOP B STOP	
	Block, Model Reaction Expectec	Circuit, Diagram, Equation, I Graph			
	Observat Look-up Output	ion Table, Table,			
9	Sample Calculatio	ons			
10	Graphs, C	Julputs		Register         □       R0         □       R1         □       R2         □       R3         □       R2         □       R3         □       R4         □       R5         □       R6         □       R7         □       R10         □       R11         □       R12         □       R13 (SP)         □       R15 (PC)         □       SPSR         □       SPSR         □       Fast Interrupt         □       Interrupt	Value           0x0000000           0x000004C           0x000004C           0x0000000           0x00000000
12 13 14	Results & Application Remarks Faculty with Date	on Areas Signature	Assembly language	programming is required t	o develop system programs

# Experiment 03 :

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	Title:	Cou	irse Plan		Page: 10 / 26
	ight ©2017. cAAS. All rights reser		ial of a number		
	Title Course Outcomes			bly language program for FACT	
				actorial of a number.	
	Material / Equipment Required	1. Desi	gning tool software KEI	L	
	Theory, Formula, Principle, Concept	Able to	o develop ARM Assemb	oly language program	
6	Procedure,		AREA Factorial, COD	E, READONLY	
	Program, Activity,		ENTRY		
	Algorithm, Pseudo Code		MOV R0,#4	; load the number in R0	
	COUE		CMP R0,#0	; check if the number is 0	
			BEQ ANS	;if number is 0, go to label A	NS
			CMP R0,#1	; check if the number is 1	
			BEQ ANS	; if number is 1, go to label A	NS
			MOV R1,R0	; Copy the number in R1	
		UP	SUBS R1,R1,#1	; decrement the value	
			in R1 till 0 BEQ	STOP ; if yes store	
			factorial value	~~~~,~~ <i>j</i> ~~~~~~~	
			MUL R2,R1,R0	; if not fact= R0 x R1	
			MOV R0,R2	; move fact value	
			B UP	,	
			;repeat until R1 is 0 A	ANS	
			MOV R0,#1		
		STOP	B STOP ; Stop		
			, <b>r</b>		
	Block, Circuit,				
	Model Diagram, Reaction Equation,				
	Expected Graph	,			
	Observation Table,	,			
	Look-up Table,	,			
	Output				
	Sample Calculations				
10	Graphs, Outputs				

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Copyr	ight ©2017. cAAS. All rights reserv				1 uge: 117 20
			Register	Value	<b></b>
			R0	0x00000018	
			R1	0x00000000	
			····· R2	0x00000018	
			R3	0x00000000	
			R4	0x00000000	
			R5 R6	0x00000000	
			R7	0x00000000	
				0x00000000	
			R9	0x00000000	
			R10	0x00000000	
			R11	0x00000000	
			····· R12	0x00000000	
			R13 (SP)	0x00000000	
			R14 (LR)	0x00000000	
			······ <mark>R15 (PC)</mark> ⊡····· CPSR	0x00000034 0x600000D3	
				0x00000000	
			±User/System	000000000	
			Fast Interrupt		
			±Interrupt		
			Supervisor		
			E Abort		
			<b>±</b> Undefined		
11	Results &Analysis				
12	Application Areas	Assembly Janquaq	e programming is require	d to develop svs	tem programs
		Assembly language			
	Remarks				
14	Faculty Signature				
	with Date				

# Experiment 04 : .....

-	Experiment No.:	4	Marks		Date		Date		
					Planned		Conducted		
1	Title	add	add an array of 16 bit numbers						
2	Course Outcomes	Able	to develop A	ARM Assemb	ly language p	orogram			
3	Aim	Wr	ite a prog	ram to ad	d an array	of 16 bit	numbers	and	
		sto	re the 32 b	oit result in	internal RA	M			
4	Material /	1. Des	signing tool s	software KEIL	-				
	Equipment								
	Required								
	Theory, Formula,								
	Principle, Concept								
	Procedure,		A ADDITION,	CODE,READO	NLY ENTRY				
	Program, Activity,		MOV R	\$5,#6	;length of a	rray			
	Algorithm, Pseudo Code		MOV R	80,#0	;initial sum				
			LDR R	1,=VALUE1	;stai	rting			
		add	lress of the a	array LOOP	LDRH R2,[	R1],#2			
					;R2	=first			
		eleı	ment of arra	У					

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		ADD R0,R0,R2 ;add first element with initial sum SUBS R5,R5,#1 BNE LOOP ;repeat addition until r5=0 LDR R4,=RESULT STR R0,[R4] ;store the result in memory STOP B STOP VALUE1 DCW 0X1111,0X2222,0X3333,0X4444,0X3333 ,0X5555 AREA DATA2,DATA,READWRITE RESULT DCD 0X0 END	
8 Obser Look- Outpu			
9 Samp Calcu	le lations		
.0 Graph	ns, Outputs		
		Memory 1	4
		Address: 0x40000000	
		0x40000000: 32 33 01 00 00 00 00 00 00 00 00 00 00 00 0x4000000D: 00 00 00 00 00 00 00 00 00 00 00 00 00	
		0x40000041: 00 00 00 00 00 00 00 00 00 00 00 00 00	
1 Resul	ts &Analysis	Call Stack + Locals Memory 1	
	ation Areas	Accombly longuage programming is required to develop evotors are the	
.2 Applic .3 Rema	cation Areas Irks	Assembly language programming is required to develop system programs	
4 Facul			

# Experiment 05 : .....

-	Experiment No.:	5	Marks	Date	Dat	e
---	-----------------	---	-------	------	-----	---

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∟ Copyr	ight ©2017. cA/	AS. All rights reser		Diar			
1	Title			Plan	sing look-up table	Conducted	
		Viteomos			Juage program using		
	Aim	ulcomes				1ber (1 to 10) using	
			look-up table.		Square or a man		
4	Material	/	1. Designing tool				
	Equipme	ent					
	Required						
	Theory,	Formula,	,				
	Principle, Procedur	, Concept re		DDE, READONLY ENTR	 >V		
	Program,			R1,#0X3		er to be squared	
	Algorithn	n, Pseudo	1010 1	R0,=LOOKUP		ng address of the looku	n tahla
	Code			,	·	•	p table
				R1,R1,LSL#0X2	; offset of value	-	
				R0,R0,R1	· 1	where square of the g	
				R3,[R0]	; load the square	ed value from look-up	table
			STOP B	STOP			
				LOOKUP	DCD		1
							I
			0X0,0X1,0x4	4,0x9,0x10,0x19,0x	24,0x31,0x40,0x51	,0x64	
					; look-up table		
			Е		- -		
			Ν				
			D				
							I
							I
	Block,	Circuit,					
	Model	Diagram,					I
	Reaction Expected	Equation,	1				
		tion Table,					
	Look-up	Table,					
	Output						

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9	Sample Calculations				Register	Value	
					Current		
					R0	0x00000040	D
					R1	0x0000028	8
					R2	0x0000000	0
					R3	0x0000064	4
					R4	0x0000000	D     C
					R5	0x0000000	D    C
					R6	0x0000000	D    C
					R7	0x0000000	
					R8	0x0000000	0
					R9	0x0000000	
					R10	0x0000000	
					R11	0x0000000	
					R12	0x0000000	
					R13 (SP)		
					R14 (LR)		
					R15 (PC)	0x00000014	
					E CPSR	0x00000D	
					⊡ <sup></sup> SPSR	0x0000000	0
					User/System		
					East Interrupt		
					Interrupt		
					+ Abort		
					Undefined		
10	Graphs, Outp	uts					
11	Results &Ana	lysis					
	Remarks		nterrupt Functions is r	required to	formulate syster	n program s	olutions
		nature					
	with Date						

### Experiment 06 : .....

-	Experiment No.:	6	Marks	Date Planned		Date Conducted	
1	Title	larg	est/smalle	est number in an arr	ay of 32 num	ibers	
2	Course Outcomes		to simulate al operations	ARM assembly langu	age for data	transfer, ari	thmetic and
3		Writ num	1 0	to find the largest/sma	llest number i	n an array o	f 32
	Material / Equipment Required	1. De:	signing tool s	software KEIL			
-	Theory, Formula, Principle, Concept						
	Procedure, Program, Activity, Algorithm, Pseudo		AREAI ENTRY	LARGE,CODE,READ Y	ONLY		

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	AND AL ONLY	Title:	Course Plan		Page: 15 / 26
Copy	right ©2017. cA	Title: AS. All rights reserve	MOV R5,#5 LDR R1,=ARRAY addressing of array array LOOP LDR R4,[R1],#4 of array CMP R2,1 1st and 2nd elemen MOV R2,R4 NEXT SUBS R5,R5,#1	<ul> <li><i>i</i> ;load starting</li> <li><i>i</i> LDR R2,[R1],#4</li> <li><i>i</i> ;load 1st element of</li> <li><i>i</i> ;load next element</li> <li><i>i</i> ;compare</li> <li><i>i</i> BHI NEXT</li> </ul>	
			0X23,0X45,0X65, ,0X12,0X99 END	0X76	
	Expected Observa Look-up Output Sample Calculati	tion Table, Table,			
10	Graphs, (	Outputs			

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			Registers		부 📧
			Register	Value	<u>▲</u>
			RO	0x00000000	
			R1	0x00000044	
			<mark>- R2</mark>	0x00000099	
			<mark>R3</mark>	0x00000000	
			<mark>- R4</mark>	0x00000099	
			R5	0x00000000	
			R6	0x00000000	
			R7	0x00000000	
			R8	0x00000000	
			R9	0x00000000	
			R10	0x00000000	
				0x0000000	
			R12	0x00000000	
			R13 (SP)	0x00000000	
			R14 (LR)	0x00000000	
			R15 (PC)	0x00000028	
				0x600000D3	
			± SPSR	0x0000000	
			User/Svstem		
	8 Apolycic				
11 Results	aAnatysis				
		RM AL and 'C' progra	amming is required to develo	p embedded sy	ystems.
13 Remark					
14 Faculty					
with Da	te				

### Experiment 07 : .....

-	Experiment No.:	7	Marks		Date Planned				ate ducteo	ł	
1	Title	Arra	inge a series	of 32 bit num	nbers in asc	cending/d	esc	endin	g orde	er.	
2			ble to simulate ARM assembly language and 'C'programs for data transfer ithmetic and logical operations					fer,			
3	Aim	asce	ending/desc	ram to a ending order		series	of	32	bit	numbers	in
	Material / Equipment Required		esigning too	l software KE	IL.						
5	Theory, Formula, Principle, Concept	9									
	Procedure, Program, Activity, Algorithm,			AREA Asc	ending,						
	Pseudo Code			CODE,							
				READONI	.Y						
				ENTRY							
MOV R8,#4 ;Length of the array											
		LDR R2,=SVALUE;Starting address of the source array LDR R3,=DVALUE;Starting									

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Conv	right ©2017 cAA	Title:	Course Plan			Page: 17 / 26
Сору	right ©2017. cAA	S. All rights reserve	LOOP0	source ary to dest a MOV R7,#3 ;R7=Number of pass MOV R5,R7 ;R5=Number of com LDR R1,=DVALU in R1 NXTCMP LDR R3,[R1]	;Loop0 copies all th ry STR R1,[R3],#4 NXTPAS parisons	tarting address ],#4 element of the
			NOSWP STOP SVALUE DATA1,DA7 DVALUE	swapping STR R2,[R1],#-4 of the array STR R3 ADD R1,R1,#4	;Swaps the elements 3,[R1] ;Decrement compar 3NE NXTCMP ;Decrement pass 3NE NXTPAS	3
7	Block, Cir Diagram, Equation, Graph					
8	Observati Look-up Output	ion Table, Table,				
	Sample C	Calculations				
10	Graphs, C	Dutputs				

		SKIT	Те	aching Process		Rev No.: 1.0	
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	AUGALONS A	Title:	Course Plan			Page: 18 / 26	
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			Memory 1	8	Memory 2		
			Address: [0x0000064	í 🔒	Address: 0x4000000		
			0x00000064: 44 00 00 00 11 00 00 00		0x40000000: 11 00 00 00 22 00		
			0x00000073: 00 64 00 00 00 00 00 00	40 00 00 00 00 00 00	0x400000D: 00 00 00 00 00 00	00 00 00 00 00 00 00	
			0x00000082: 00 00 00 00 00 00 00 00 00	00 00 00 00 00 00 00	0x4000001A: 00 00 00 00 00 00		
			0x00000091: 00 00 00 00 00 00 00 00 00	00 00 00 00 00 00 00	0x40000027: 00 00 00 00 00 00	00 00 00 00 00 00 00	
			0x000000A0: 00 00 00 00 00 00 00 00 00	00 00 00 00 00 00 00	0x40000034: 00 00 00 00 00 00	00 00 00 00 00 00 00	
			T 0x000000AF: 00 00 00 00 00 00 00 00 00	00 00 00 00 00 00 00	0x40000041: 00 00 00 00 00 00	00 00 00 00 00 00 00	
			V 0x000000BE: 00 00 00 00 00 00 00 00	00 00 00 00 00 00 00	0x4000004E: 00 00 00 00 00 00	00 00 00 00 00 00 00	
			0x000000CD: 00 00 00 00 00 00 00 00	00 00 00 00 00 00 00	0x4000005B: 00 00 00 00 00 00	00 00 00 00 00 00 00	
			V <mark>0x00000DC: 00 00 00 00 00 00 00 00 00 00 00 00 00</mark>	• 00 00 00 00 00 00 00	0x40000068: 00 00 00 00 00 00	- 00 00 00 00 00 00 00	
11	Results	&Analysis					
			ARM AL and 'C' program	ming is required t	o develop embedo	ded systems.	
	Remarks						
14	Faculty with Dat	Signature e					

### PART B



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## Experiment 09: .....

-	Experiment No.:	8a	Marks		Date Planned		Date Conducted	
1	Title 1.	Disp	lay "Hello	World" me		g Internal		
2	Course Outcomes		to Design a					external I/O
3	Aim <b>2.</b>	Disp	lay "Hello	World" me	ssage usin	g Internal	UART.	
	Material / Equipment Required					-		
	Theory, Formula, Principle, Concept							
6	Principle, Concept Procedure, Program, Activity, Algorithm, Pseudo Code	voi uar irq tem 0x0 cha tx_ int { PIN U0 div data U0 bau U0	t_interrupt(v ; unsigned c p, temp1 = 00; unsigned r rx_flag = 0 flag = 0; main(void) NSEL0=0X0 LCR = 0X00 isor loading a format DLL = 0x13 id rate 9600 IER = 0X03	void) char d 0, 0000005; 0000083; and U0DLM 3; bps U0LCR ;	//en 1 = 0X00; //sel = 0X00000 //sele	able baud r //select ect 003; ct Transmit	the t and Recieve	interrupt
		I V	NTERRUP' VIC channel	dr0 = (unsignT VICVectC)uart-0 to int	ntl0 = 0x20  terrupt priori	- 6; ty 0	// Assig	
		V { V	vhile(1) while(rx_fla eive flag to	= 0x0000004 g == 0x00); set rx_flag =	//wa	uit for	t-0 interrupt	
			THR = temp	o1;				

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R	Block, Circuit, Model Diagram, Reaction Equation, Expected Graph		
	Dbservation Table, .ook-up Table, Dutput		
	ample		
	Calculations		
	Graphs, Outputs		
	esults &Analysis?		
		ALP to interface with external I/O devices is used to design in of computers with external devices	terfacing solutions
	Remarks		
	aculty Signature vith Date		

### Experiment 10: .....

-	Experiment No.:	10	Marks		Date		Date	
---	-----------------	----	-------	--	------	--	------	--

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Соруг	Ignt @2017. CA	A.S. All fights reser	lea.	Planned	Conducted
	Title		Interface and Contr		
			I/O devices		rograms to interface with external
	Aim		Interface and Contr	ol a DC Motor	
	Material Equipme	/			
	Required				
5	Theory,	Formula,			
		, Concept			
	Procedu	re, , Activity,	#in		
		n, Pseudo	clu		
	Code	,	de		
			<lp< td=""><td></td><td></td></lp<>		
			c2		
			14		
			x.h		
			>		
			voi		
			d		
			clo		
			ck		
			W		
			ise		
			(vo		
			(vo id);		
			void		
			anti_clo		
			ck_wise		
			(void);		
			unsigne		
			d int		
			j=0;		
			int main()		
			{		
			PINSEL2 = 0X	FFFFFFF0;	
			//IO1CLF	R = 0X0000ff00;	
			IO1DIR=	= 0X00030000;	//p1.16 and
			p1.17 are	selected as outputs. IO1S	
			0X00010		
			while(1)		
			winne(1)		
			٤		
			clock_wi	se();	

		SKIT	1	Teaching Proc	cess	Rev No.: 1.0
	sa)	Doc Code	-			Date: 3-12-2018
	CONCORT OF	Title:	Course Plan			Page: 22 / 26
Copyr	1901 ©2017. CA	AS. All rights reser	for(j=0;j<500 anti_clock_wi		//delay	
			for(j=0;j<500	000;j++);	//delay	
			}		//End of while(1) //End of Main	
			void clock_wise(void	)		
	<pre>for(j=0;j&lt;500000;j++);//small delay to allow motor to tu IO1SET = 0X00030000; //Selecting the P1.17 line for cl and turn on motor }</pre>					
			void anti_clock_wise	(void)		
			IO1CLR = 0X000300 relay	)00;	//stop motor a	nd also turn off
			for(j=0;j<1000000;j- turn off	++);	//small delay to	o allow motor to
			IO1SET = 0X000100 Anti clockwise	000;	//not selecting	the P1.17 line for
			}			
	Block, Model Reaction Expected	Circuit, Diagram, Equation, d Graph				
8		tion Table,				
9	Sample Calculati	ons				
10	Graphs, (	Dutputs				
11	Results 8	Analysis				
			8086 ALP to interface solutions of computers		I/O devices is used to devices	design interfacing
	Remarks					
14	Faculty with Date	Signature e				



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### Experiment 11: .....

-	Experiment No.:	11 Marks	Dat Planr		Date Conducted
1	Title	Interface a S		tate it in clockwi: rection.	se and anti-clockwise
2	Course Outcomes	Able to Design ai I/O devices	nd develop 8086ass	embly programs	to interface with external
3	Aim	Interface a		and rotate if wise direction	t in clockwise and n.
4	Material / Equipment Required				
5	Theory, Formula, Principle, Concept	,			
6	Procedure, Program, Activity, Algorithm, Pseudo Code	<pre>void anti_cloc k_wise(v oid); unsigned int var1; unsigned long int main(void) { PINSEI IO1DIF while(1 { for(j = wise Ro round c IO1CLI //clearin for(k = show an</pre>	) 0; j < 50; j++) ptation clock_wise() clockwise R =0x00F00000; ng all 4 bits while(1 = 0; k < 65000; k+- nti_clock Rotation f n Anti Clock wise R	0; //P1.20 to P1.2 //P1.20 to P1.2 //P1.20 to P1.2 ); +); For( j=0; j < 50;	23 made as output Clock e one // Delay to ; j++ ) // 50 ck_wise() ;

	SK	IT	Teaching Process	Rev No.: 1.0
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			for( k = 0 ; k < 65000 ; k++ ) ; Rotation	<pre>// Delay to show ANTI_clock</pre>
			}	
		}	// End of main	
7	Block, Cir Model Diagi Reaction Equa Expected Grapł	tion,		
8	Observation Ta Look-up Ta Output	able, able,		
	Sample Calculations			
	Graphs, Output			
	Results &Analys			
	Application Are		nterface with external I/O devices is u omputers with external devices	ised to design interfacing solutions of
13	Remarks			
14	Faculty Signa with Date	ture		

### Experiment 12: .....

-	Experiment No.:	12	Marks		Date	Date	
					Planned	Conducted	
1		Determine Digital output for a given Analog input using Internal ADC of ARM controller.					
2	Course Outcomes		Able to Design and develop 8086assembly programs to interface with external /O devices				
3	Aim	Determine Digital output for a given Analog input using Internal ADC of ARM controller.					
	Material / Equipment Required						
-	Theory, Formula, Principle, Concept						
6	Procedure,	edure, #include <lpc214x.h> #include <stdio.h></stdio.h></lpc214x.h>					
	Program, Activity, Algorithm, Pseudo Code		efine vol 3.3		//		
		Ref	ference volta	ge #define			
		full	scale 0x3ff				



	unsigned int data_lcd=0,i=0,n=0; unsigned int adc_value=0,temp_adc=0,temp1,temp2,			
void	27,			
delay	delay			
	int main()			
{ PINSEL1 = 0X04000000;				
//AD0.2 pin is				
selected IO0DIR = $0x000000FC$ ;				
//configure o/p				
lines for lcd				
delay(3200); lcd_init(); //LCD_initialization				
lcd_init(); //LCD initialization delay(3200);				
clr_disp(); //clear display				
delay(3200); //delay				
ptr = dis;				
temp1 = $0x80$ ; //Display starting address of 1st				
line on LCD lcd_com(); delay(800);				
while(*ptr!='\0')				
ptr; lcd data();				
ptr ++;				
}				
7 Block, Circuit, Model Diagram,				
Reaction Equation, Expected Graph				
8 Observation Table,	-			
Look-up Table,				
Output				
9 Sample Calculations				
10 Graphs, Outputs				

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11	Results &Analysis	
12	Application Areas	interface with external I/O devices is used to design interfacing solutions of
		computers with external devices
13	Remarks	
14	Faculty Signature	
	with Date	

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