	National Institute of Technology Meghalaya	CURRICULUM
	National Institute of Technology Meghalaya An Institute of National Importance	**CURRICULUM**

Programme	**Master of Technology in in VLSI and Embedded Systems**	Year of Regulation	**2018-19**
Department	**Electronics and Communication Engineering**	Semester	**II**

Course Code	Course Name	Credit Structure				Marks Distribution			
		L	T	P	C	INT	MID	END	Total
EC 522	**Advanced System on Chip Design**	**3**	**0**	**0**	**3**	**50**	**50**	**100**	**200**

Course Objectives	Develop Arm Cortex-M0 based SoCs from high-level functional specifications to design	Course Outcomes	CO1	Able to understand ARM processor architecture and interface low-level IPs through HDL model
	Implement and test on real FPGA hardware using standard hardware description and software programming languages		CO2	Able to programme multiple programme languages
	Realize complex Applications with the developed hardware		CO3	Able to evaluate implementation results (e.g. speed, area, power) and correlate them with the corresponding high-level design and capture
			CO4	Ability to use commercial tools to develop Arm-based SoCs

No.	COs	Mapping with Program Outcomes (POs)												Mapping with PSOs		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	CO1	3	3	2	1	1	3	-	-	2	-	-	1	3	3	1
2	CO2	3	2	1	1	-	-	1	-	2	-	-	1	2	2	1
3	CO3	2	3	3	1	2	0	-	1	0	-	1	2	3	2	1
4	CO4	2	2	3	0	2	2	3	-	2	-	-	1	1	2	3

	SYLLABUS		
No.	Content	Hours	COs
I	Processor Logic Implementation Verilog RTL Design with examples and Processor basics and implementation.	5	CO1
II	ARM Processor Architecture Introduction to Programmable SoCs, Types of Processors, Cortex- M0 and M3 Processor Architectures, Addressing modes, Instruction decoding, Programming, usage of DS-5kit. Bus interfaces APB, AHB, AMBA3 AHB-Lite, Full, Bus protocols , AHB SRAM Memory Controller, AHB UART Peripheral, AHB Timer, GPIO and 7-segment Display Peripherals, AHB VGA Peripheral, Interrupt Mechanisms, CMSIS and Software Drivers for DSP Development , Development of Applications SNAKE Game, Floating point multiplier , AES encryption etc.	12	CO2, CO3
III	Advanced ARM Processor Architecture and Programming Introduction to Armv7 Architecture, Arm Cortex-A9 Processors, AMBA Bus Architecture AXI lite, Full, and stream, AXI GPIO Peripheral and DDR Memory Controller, AXI4-Stream and VGA Peripheral, AXI-Stream HDMI Input Peripheral, System Debugging, Applications: Image Processing, encryption applications	19	CO4
	Total Hours	36	

Essential Readings

1. S. Furber ARM System-on-chip Architecture 2nd Edition Addison Wesley, 2000

2. A. G. Dean Embedded Systems Fundamentals with Arm Cortex-M based Microcontrollers: A Practical Approach, ARM Education Media, 2017.

3. L. H. Crockett, R. A. Elliot, M. A. Enderwitz, and R. W. Stewart The Zynq Book Embedded Processing with the ARM® Cortex®-A9 on the Xilinx® Zynq®-7000 All   Programmable SoC, Strathclyde Academic Media, 2014.

Supplementary Readings

1. J. Yiu, The Definitive Guide to the ARM Cortex-M0 and Cortex-M0+ Processors, Newnes, 2nd Edition, 2015.

2. R. Toulson Fast and Effective Embedded Systems Design: Applying the ARM mbed, Newnes, 2nd Edition, 2016.