

Course Code	Course Title	L	T	P	C
1152EC215	SYSTEM ON CHIP (SOC)	1	0	4	3

a) **Course Category**

Program Elective

b) **Preamble**

The primary focus of this integrated course “System on Chip” is the development of an embedded system using a current-day system on a chip (SoC) which consists of several different microprocessor subsystems together with memories and I/O interfaces. Students will also get an opportunity to design and implement the algorithms that are specific to real time systems/applications.

c) **Prerequisite**

Nil

d) **Related Courses**

Embedded System Design, Reconfigurable Computing with FPGA

e) **Course Outcome**

Upon the successful completion of the course, students will be able to:

CO Nos.	Course Outcomes	Skill Level (Based on Dave’s Taxonomy)
CO1	Recreate the functionality of soft core and hard cores	S4
CO2	Enact the sub modules of Programmable SoC	S4
CO3	Demonstrate the programmable system on Chip interfacing with Peripheral devices	S4

f) **Correlation of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M	L	H	L	H	L	L	-	-	-	-	M	M	-
CO2	M	M	H	L	H	L	L	-	-	-	-	M	M	M
CO3	M	L	H	L	H	L	L	L	-	-	-	M	M	M

g) Examination Scheme for practical dominated course										
Internal evaluation (40M)							Semester end evaluation (60M)			
Laboratory experiment (15M)				Model laboratory test (25M)			Part-A (20M)	Part-B (40M)		
Performance in conducting experiment (5)	Result and analysis (3)	Viva Voc (3)	Record (4)	Performance in conducting experiment (15)	Result and analysis (5)	Viva Voc (5)	Theory questions to evaluate the knowledge and understanding (20)	Performance in conducting experiment (25)	Result and analysis (10)	Viva Voc (5)

h) Course Content :

Theory

15 Hours

Introduction to System on Chip – Architecture – Components – Hardware and Software – Interconnections – Customization.

ARM architecture – Organization and Implementation – Instructions – Assembly Language Programming – Processor Cores.

PSoC Architecture – Structure – Modules – Interconnects – Memory Management – Multiple Configurations – Project Running.

APSoC Architecture – IP Creation – IP Integration – Implementation.

Embedded System on SoC – Application – Automation.

i) List of experiments

S. No	CO Mapping	Practical Exercises (60 Hours)
1.	CO1	Introduction to Vivado Design Suite environment

2.	CO1	Synthesis and Implementation of Microblaze Processor.
3.	CO1	Creation of Custom IP Cores with the IP Integrator Utility.
4.	CO1	Creation of an Embedded Programmable System on Chip.
5.	CO2	Analog GPIO Driving using PSoC
6.	CO2	Digital GPIO Driving using PSoC
7.	CO2	Design and implementation of OpAmps for ADC using PSoC.
8.	CO2	Generation of PWM signal to drive servo motor using PSoC.
9.	CO2	Filter Design and Implementation using PSoC.
10.	CO2	Design and Implementation of DMA Controller using PSoC.
11.	CO2	Dynamic Reconfiguration using PSoC.
12.	CO3	Implementation of Arithmetic and Logical Unit in APSoC Architecture.
13.	CO3	Develop a System to Control the Speed of Motor in APSoC Architecture
14.	CO3	Interface a Temperature Sensor Module with APSoC architecture
15.	CO3	Design and Implementation of Embedded System on a Chip for Real Time Application

Total 75 hrs

j) Learning Resources

Textbooks

1. Michael J. Flynn, Wayne Luk, "Computer System Design: System-on-Chip", Wiley Publishers, OCT 2011.
2. Steve Furber, "ARM System-on-Chip Architecture" (2nd Edition) 2nd Edition, Pearson Education Limited, 2000.
3. Robert Ashby, "Designer's Guide to the Cypress PSoC (Embedded Technology)" Elsevier, 2005.
4. Louise Crockett, Ross A Elliot, Martin A Enderwitz, "The Zynq Book Tutorials for Zybo and ZedBoard Paperback", University of Strathclyde Glasgow, 2015
5. Nurmi J, "Processor Design System-On-Chip Computing for ASICs and FPGAs", Springer 2007

List of Major Equipment/ Instrument/Software with Broad Specifications

1. Vivado Compiler (Licensed version)
2. Cypress PSoC Board
3. Xilinx Zybo Board

List of Software/Learning Websites

1. <https://www.xilinx.com/>
2. <http://www.cypress.com/>
3. <https://www.arm.com/>

Online resources

1. <http://nptel.ac.in/courses/108102045/10>