



National Institute of Technology Meghalaya
An Institute of National Importance

CURRICULUM

Programme	Bachelor of Technology in Computer Science and Engineering	Year of Regulation	2020-21
Department	Computer Science and Engineering	Semester	IV

Course Code	Course Name	Credit Structure				Marks Distribution			
		L	T	P	C	INT	MID	END	Total
CS 218	Computer Arithmetic	3	0	0	3	50	50	100	200

Course Objectives	Course Outcomes	CO1	CO2	CO3	CO4	CO5
		Identify, understand and apply different number systems and codes.	Understand and use the different algorithms for addition/subtraction of binary numbers.	Understand the concept of multipliers and their hardware realizations.	Understand the concept of advanced dividers and their hardware realizations.	Understand the concept of floating point number representations and algorithms used for real arithmetic operations.

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	2	3	2	1	0	0	0	0	0	0	1	2	3	1
2	CO2	3	2	3	2	1	0	0	0	0	0	0	0	2	3	1
3	CO3	3	2	3	2	1	0	0	0	0	0	0	0	2	3	1
4	CO4	3	2	3	2	1	0	0	0	0	0	0	0	2	3	1
5	CO5	3	2	3	2	1	0	0	0	0	0	0	0	2	3	1

SYLLABUS

No.	Content	Hours	COs
I	Numbers and Arithmetic: Different encoding of numbers, Fixed radix positional number system, Number radix conversion, Classes of number systems, Introduction to signed numbers.	05	CO1
II	Addition and subtraction: Bit-Serial and Ripple-Carry Adders, Conditions and Exceptions, Analysis of Carry Propagation, Carry Completion Detection, Addition of a Constant, Counters, Manchester Carry Chains and Adders, Carry Recurrence, Carry-Lookahead Adders, Adders and Related Designs, Carry Determination as Prefix Computation, Alternative Parallel Prefix Networks, Hardware Implementations.	08	CO2
III	Multipliers: Shift/Add Multiplication Algorithms, Programmed Multiplication, Basic Hardware Multipliers, Multiplication of Signed Numbers, Multiplication by Constants, Radix-4 Multiplication, Booth's multiplication, Modified Booth's Recoding, Using Carry-Save Adders, Radix-8 and Radix-16 Multipliers, The Special Case of Squaring, Combined Multiply-Add Units.	09	CO3
IV	Dividers: Basic division schemes, Shift/Subtract Division Algorithms, Programmed Division, Restoring Hardware Dividers, Nonrestoring and Signed Division, Division by Constants, Fast Dividers, Basics of High-Radix Division, Radix-2 SRT Division, Using Carry-Save Adders, Choosing the Quotient Digits, Radix-4 SRT Division, General High-Radix Dividers. Square-rooting methods: Pencil-and-Paper Algorithm, Binary Restoring Shift/Subtract Algorithm, Nonrestoring Algorithm, High-Radix Square-Rooting.	08	CO4
V	Floating-point: different representations, floating-point standards, basic floating-point algorithms, conversions and exceptions, rounding schemes, logarithmic number systems, Floating-point arithmetic: floating-point adders/subtractors, pre and post shifting, rounding and exceptions, floating-point multipliers, floating-point dividers, logarithmic arithmetic unit, errors and error control, sources of computational errors, invalidated laws of algebra, worst-case error accumulation, error distribution and expected errors, forward error analysis, backward error analysis.	09	CO5
Total Hours		39	

Essential Readings:

- Behrooz Parhami, "Computer Arithmetic: Algorithms and Hardware Designs", 1st ed., 2000, Oxford university press.
- Mi Lu., "Arithmetic and logic in computer systems", 1st ed., 2004, John Wiley and Sons.
- Paul Zimmermann and Richard Brent, "Modern Computer Arithmetic", 1st ed. 2010, Cambridge university press.

Supplementary Readings:

- Donald e. Knuth., "The art of computer programming", 2nd ed., 1985, Addison-Wesley publishing company.
- M Ercegovac, T Lang, "Digital Arithmetic", Hardware and Programming", 1st ed., 2004, Morgan Kaufmann publishers.
- Israel Koren, "Computer Arithmetic Algorithms", 2nd ed., 2002, A.K. Peters.