Uka Tarsadia University

B. Tech.

Semester V

DESIGN AND DEVELOPMENT EMBEDDED SYSTEMS

CE5021

Effective from June-2023

Syllabus version: 1.00

Subject Code	Subject Title	Teaching Scheme			
		Hours		Credits	
		Theory	Practical	Theory	Practical
CE5021	Design and Development Embedded Systems	3	2	3	2

Subject Code	Subject Title	Theory Examination Marks		Practical Examination Marks	Total Marks
		Internal	External	CIE	
CE5021	Design and Development Embedded Systems	40	60	50	150

Objectives of the course:

- To understand the basic concepts of embedded system.
- To understand design and development of embedded system.

Course outcomes:

Upon completion of the course, the student shall be able to,

CO1: To understand the basics the basic concepts of embedded system design.
CO2: Analyse the specification and modelling of embedded design.
CO3: To develop the hardware and software for embedded system.
CO4: Analyse evaluation and validation for embedded system.
CO5: To apply knowledge of application mapping in embedded design.
CO6: To optimize and test different embedded system.

Sr. No.	Topics	Hours
	Unit – I	
1	**Introduction:** Application areas and examples, Common characteristics, Challenges in embedded system design, Design flows.	5
	Unit – II	
2	**Specifications and Modeling:** Requirements, Models of computation, Early design phases, Communicating finite state machines (CFSMs), Data flow, Petri nets, Discrete event based languages, Von-Neumann languages, Levels of hardware modeling, Comparison of models of computation.	6
	Unit – III	

3	**Embedded System Hardware and Software:** Introduction, Input, Processing Units,Memories, Communication, Output, Embedded Operating Systems, ERIKA, Hardware abstraction layers, Middleware, Real-time databases.	7
	Unit – IV	
4	**Evaluation and Validation:** Introduction, Performance evaluation, Energy and power models, Thermal models, Risk and dependability analysis, Simulation, Rapid prototyping and emulation, Formal Verification.	5
	Unit – V	
5	**Application Mapping:** Problem definition, Scheduling in real-time systems, Hardware/software partitioning, Mapping to heterogeneous multi-processors.	6
	Unit – VI	
6	**Optimization and Test:** Task level concurrency management, High-level optimizations, Compilers for embedded systems, Power Management and Thermal Management, Scope, Test procedures, Evaluation of test pattern sets and system robustness, Design for testability.	7

Text book:

1. Peter Marwedel, "Embedded Systems", 2nd Edition, Springer.

Reference books:

1. Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, "Cloud Computing A practical Approach", McGrawHill.
2. RajkumarBuyya, James Broberg, Andrzej Goscinski, "Cloud Computing Principles and Paradigams", Wiley Publication.

Course objectives and Course outcomes mapping:

- To understand the basic concepts of embedded system: CO1, CO2, and CO3
- To understand development of embedded system: CO4, and CO6

Course units and Course outcomes mapping:

Unit No.	Unit Name	Course Outcomes					
		CO1	CO2	CO3	CO4	CO5	CO6
1	Introduction	✓					
2	Specifications and Modeling		✓				
3	Embedded System Hardware and Software			✓			
4	Evaluation and Validation				✓		
5	Application Mapping					✓	
6	Optimization and Test						✓

Programme outcomes:

PO 1: Engineering knowledge: An ability to apply knowledge of mathematics, science, and engineering.

PO 2: Problem analysis: An ability to identify, formulates, and solves engineering problems.

PO 3: Design/development of solutions: An ability to design a system, component, or process to meet desired needs within realistic constraints.

PO 4: Conduct investigations of complex problems: An ability to use the techniques, skills, and modern engineering tools necessary for solving engineering problems.

PO 5: Modern tool usage: The broad education and understanding of new engineering techniques necessary to solve engineering problems.

PO 6: The engineer and society: Achieve professional success with an understanding and appreciation of ethical behavior, social responsibility, and diversity, both as individuals and in team environments.

PO 7: Environment and sustainability: Articulate a comprehensive world view that integrates diverse approaches to sustainability.

PO 8: Ethics: Identify and demonstrate knowledge of ethical values in non-classroom activities, such as service learning, internships, and field work.

PO 9: Individual and team work: An ability to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give/receive clear instructions.

PO 11: Project management and finance: An ability to demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO 12: Life-long learning: A recognition of the need for, and an ability to engage in life-long learning.

Programme outcomes and Course outcomes mapping:

Programme Outcomes	Course Outcomes					
	CO1	CO2	CO3	CO4	CO5	CO6
PO1	✓	✓				
PO2			✓	✓		
PO3		✓	✓			
PO4				✓	✓	
PO5			✓			✓
PO6				✓		✓
PO7	✓	✓				
PO8						✓
PO9					✓	✓
PO10			✓	✓		
PO11		✓			✓	
PO12						✓