Course Type	Course Code	Name of Course	L	T	P	Credit
DE	ECD407	Embedded Systems	3	0	0	9

Course Objective
To impart knowledge on the following topics
• Understand the concepts of embedded system design and analysis
• Learn the architecture and programming of ARM processor
• Be exposed to the basic concepts of embedded programming
• Learn the real time operating systems
Learning Outcomes
• Describe the architecture and programming of ARM processor
• Outline the concepts of embedded systems
• Explain the basic concepts of real time operating system design
• Model real-time applications using embedded-system concepts

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1	Module 1: INTRODUCTION TO EMBEDDED SYSTEM DESIGN Complex systems and microprocessors– Embedded system design process –Design example: Model train controller- Design methodologies- Design flows - Requirement Analysis – Specifications-System analysis and architecture design – Quality Assurance techniques - Designing with computing platforms – consumer electronics architecture – platform-level performance analysis.	09	To understand the basic concept of embedded systems
2	Module 2: ARM PROCESSOR AND PERIPHERALS ARM Architecture Versions – ARM Architecture – Instruction Set – Stacks and Subroutines – Features of the LPC 214X Family – Peripherals – The Timer Unit – Pulse	08	To get a profound knowledge on arm processor and its peripherals
3	Module 3: EMBEDDED PROGRAMMING Components for embedded programs- Models of programs- Assembly, linking and loading – compilation techniques- Program level performance analysis – Software performance optimization – Program level energy and power analysis and optimization – Analysis and optimization of program size- Program validation and testing.	08	To get a profound knowledge in programming in the embedded processors
4	Module 4: REAL TIME SYSTEMS Structure of a Real Time System –– Estimating program run times – Task Assignment and Scheduling – Fault Tolerance Techniques – Reliability, Evaluation – Clock Synchronisation.	08	To understand the concept and working of real time systems
5	Module 5: PROCESSES & OPERATING SYSTEMS Introduction – Multiple tasks and multiple processes – Multirate systems- Preemptive real-time operating systems- Priority based scheduling- Interprocess communication mechanisms – Evaluating operating system performance- power optimization strategies for processes – Example Real time operating systems-POSIX-Windows CE. - Distributed embedded systems – MPSoCs and shared memory multiprocessors. – Design Example - Audio player, Engine control unit – Video accelerator.	09	Capable of handling multi tasks and multi process systems To understand the concept of real time operating systems

Text Books:
1. Marilyn Wolf, ―Computers as Components - Principles of Embedded Computing System Design‖, Third Edition ―Morgan Kaufmann Publisher (An imprint from Elsevier), 2012.
2. Jane W.S.Liu, Real Time Systems‖, Pearson Education, Third Indian Reprint, 2003.

References:
1. Lyla B.Das, ―Embedded Systems: An Integrated Approach, Pearson Education, 2013.
2. Jonathan W.Valvano, ―Embedded Microcomputer Systems Real Time Interfacing, Third Edition Cengage Learning, 2012.
3. David. E. Simon, ―An Embedded Software Primer, 1st Edition, Fifth Impression, Addison-Wesley Professional, 2007.
4. Raymond J.A. Buhr, Donald L.Bailey, ―An Introduction to Real-Time Systems- From Design to Networking with C/C++, Prentice Hall, 1999.
5. C.M. Krishna, Kang G. Shin, ―Real-Time Systems, International Editions, Mc Graw Hill 1997
6. K.V.K.K.Prasad, ―Embedded Real-Time Systems: Concepts, Design & Programming, Dream Tech Press, 2005.
7. Sriram V Iyer, Pankaj Gupta, ―Embedded Real Time Systems Programming, Tata Mc Graw Hill, 2004.