

<b>Course Title:</b>	<b>INTRODUCTION TO EMBEDDED SYSTEMS</b>		
Course Code:	<b>BETCK105J-205J</b>	CIE Marks	50
Course Type (Theory/Practical /Integrated )	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P: S)	3:0:0:0	Exam Hours	03
Total Hours of Pedagogy	40 hours	Credits	03
<b>Course objectives:</b> To teach students <ul style="list-style-type: none"> <li>• Introductory topics of Embedded System design</li> <li>• Characteristics &amp; attributes of Embedded System</li> <li>• Introduction of Embedded System Software and Hardware development</li> <li>• RTOS based Embedded system design</li> </ul>			
<b>Teaching-Learning Process</b> These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes and make Teaching –Learning more effective <ol style="list-style-type: none"> <li>1. Lecturer method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.</li> <li>2. Show Video/animation films to explain the functioning of various analog and digital circuits.</li> <li>3. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it.</li> <li>4. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.</li> <li>5. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.</li> </ol>			
<b>Module-1 (8 Hours)</b>			
<b>Introduction:</b> Embedded Systems and general purpose computer systems, history, classifications, applications and purpose of embedded systems <b>Chapter 1 – Text 1</b> <b>Core of Embedded Systems :</b> Microprocessors and microcontrollers, RISC and CISC controllers, Big endian and Little endian processors, Application specific ICs, Programmable logic devices, COTS, sensors and actuators, communication interface, embedded firmware, other system components, PCB and passive components <b>Chapter 2 – Text 1</b>			
<b>Module-2(8 Hours)</b>			
<b>Characteristics and quality attributes of embedded systems:</b> Characteristics, Operational and nonoperational quality attributes, application specific embedded system - washing machine, domain specific – automotive <b>Chapter 3 &amp; 4 – Text 1</b>			
<b>Module-3(8 Hours)</b>			
<b>Hardware Software Co design and Program Modelling :</b> Fundamental issues in Hardware Software Co-design, Computational models in Embedded System Design <b>Chapter 7 – Text 1: 7.1, 7.2</b> <b>Embedded Hardware Design and Development:</b> Analog Electronic Components, Digital Electronic Components, VLSI & Integrated Circuit Design, Electronic Design Automation Tools <b>Chapter 8 – Text 1: 8.1, 8.2, 8.3, 8.4</b>			
<b>Module-4(8 Hours)</b>			

<p><b>Embedded Firmware Design and Development:</b> Embedded Firmware Design Approaches, Embedded Firmware Development Languages <b>Chapter 9 – Text 1: 9.1, 9.2</b></p> <p><b>Embedded System Development Environments:</b> Types of files generated on cross compilation (only explanation – programming codes need not be dealt), disassemble/decompiler, Simulators, Emulators and Debugging <b>Chapter 13 – Text 1: 13.2, 13.3,13.4</b></p>	
<b>Module-5(8 Hours)</b>	
<p><b>Real-time Operating System(RTOS) based Embedded System Design:</b> Operating System basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling <b>Chapter 10 – Text 1: 10.1 to 10.5</b></p>	
<b>Course outcome (Course Skill Set)</b>	
At the end of the course the student will be able to:	
C01	Explain characteristics of Embedded System design
C02	Acquire knowledge about basic concepts of circuit emulators, debugging and RTOS
C03	Analyse embedded system software and hardware requirements
C04	Develop programming skills in embedded systems for various applications.
C05	Design basic embedded system for real time applications
<b>Assessment Details (both CIE and SEE)</b>	
<p>The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). The minimum passing mark for the SEE is 35% of the maximum marks (18 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.</p>	
<b>Continuous Internal Evaluation(CIE):</b>	
Three Tests each of 20 Marks;	
<ul style="list-style-type: none"> <li>• 1<sup>st</sup>, 2<sup>nd</sup>. and 3<sup>rd</sup> tests shall be conducted after completion of the syllabus of 30-35%, 70-75%, and 90-100% of the course/s respectively.</li> <li>• Assignments/Seminar/quiz/group discussion /field survey &amp; report presentation/ course project/Skill development activities, suitably planned to attain the COs and POs for a total of 40 Marks.</li> </ul>	
If the nature of the courses requires assignments/Seminars/Quizzes/group discussion two evaluation components shall be conducted. If course project/field survey/skill development activities etc then the evaluation method shall be one.	
Total CIE marks (out of 100 marks) shall be scaled down to 50 marks	
<b>Semester End Examination (SEE):</b>	
Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject ( <b>duration 03 hours</b> )	

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- The question paper shall be set for 100 marks. The medium of the question paper shall be English). The duration of SEE is 03 hours.
- The question paper will have 10 questions. Two questions per module. Each question is set for 20 marks. The students have to answer 5 full questions, selecting one full question from each module. The student has to answer for 100 marks and **marks scored out of 100 shall be proportionally reduced to 50 marks.**
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

**Suggested Learning Resources:**

**Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)**

1. Shibu K V, "Introduction to Embedded Systems", Second Edition, McGraw Hill Education

**Web links and Video Lectures (e-Resources):**

NPTL Lectures: <https://nptel.ac.in/courses/108102045>

Embedded Systems, IIT Delhi, Prof. Santanu Chaudhary

**Activity Based Learning (Suggested Activities in Class)/ Practical Based learning**

- To design a simple Embedded System like simple remote
- To demonstrate simple microcontroller based experiments like LED interfacing, LCD interfacing, DAC etc