Department of Electrical and Electronics Engineering

COURSE MODULE OF THE COURSE TAUGHT FOR THE SESSION FEB-MAY: 2024-25

Course Syllabus with CO's

Faculty Name: Shreeshayana R			**Academic Year: 2024-25**				
Department: Electrical and Electronics Engineering							
Course Code	Course Title	Core/Elective	Prerequisite	Contact Hours			Total Hrs/ Sessions
				L	T	P	
BEE613B	Embedded Systems Design	Professional Elective	C Programming, Microcontrollers fundamentals	3	-	-	40 Hours
Objectives	1. Introductory topics of Embedded System design 2. Characteristics & attributes of Embedded System 3. Introduction of Embedded System 4. Software and Hardware development RTOS based Embedded system design						
Topics Covered as per Syllabus							
MODULE-1 **Introduction**: Embedded Systems and general purpose computer systems, history, classifications, applications and purpose of embedded systems (Chapter 1 – Text 1) Core of Embedded Systems : 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 (Chapter 2 – Text 1)							
Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding						
MODULE-2 **Characteristics and quality attributes of embedded systems**: Characteristics, Operational and nonoperational quality attributes, application specific embedded system - washing machine, domain specific – automotive (Chapter 3 & 4 – Text 1)							
Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding						
MODULE-3: **Hardware Software Co design and Program Modelling** : Fundamental issues in Hardware Software Co-design, Computational models in Embedded System Design (Chapter 7 – Text 1: 7.1, 7.2) Embedded Hardware Design and Development: Analog Electronic Components, Digital Electronic Components, VLSI & Integrated Circuit Design, Electronic Design Automation Tools (Chapter 8 – Text 1: 8.1, 8.2, 8.3, 8.4)							
Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding, L_3 – Applying						
MODULE-4 **Embedded Firmware Design and Development:** Embedded Firmware Design Approaches, Embedded Firmware Development Languages (Chapter 9 – Text 1: 9.1, 9.2) Embedded System Development Environments: Types of files generated on cross compilation (only explanation – programming codes need not be dealt), disassemble/decompliler, Simulators, Emulators and Debugging (Chapter 13 – Text 1: 13.2, 13.3,13.4)							
Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding, L_3 – Applying L_4– Analysing						
MODULE-5 Real-time Operating System(RTOS) based Embedded System Design: Operating System basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling (Chapter 10 – Text 1: 10.1 to 10.5)							
Bloom's Taxonomy Level	L_1 – Remembering, L_2 – Understanding, L_3 – Applying. L_4– Analysing						

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List of Text Books
Shibu K V, "Introduction to Embedded Systems", Second Edition, McGraw Hill Education
List of Additional Reference Books/URLs, Text Books, Notes, Multimedia Content, etc
1. NPTL Lectures: https://nptel.ac.in/courses/108102045 Embedded Systems, IIT Delhi, Prof. Santanu Chaudhary 2. https://www.arduino.cc 3. https://www.raspberrypi.org/ 4. Course in Internet of Things (IOT) Using Arduino - NIELIT Delhi Centre 5. Vijay Madisetti, Arshdeep Bahga, Internet of Things. "A Hands on Approach", University Press 6. Dr. SRN Reddy, Rachit Thukral and Manasi Mishra, "Introduction to Internet of Things: A practical Approach", ETI Labs 7. Pethuru Raj and Anupama C Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press 8. Jeeva Jose, "Internet of Things", Khanna Publishing House, Delhi 9. Adrian McEwen, "Designing the Internet of Things", Wiley 10. Raj Kamal, "Internet of Things: Architecture and Design", McGraw Hill 11. https://projecthub.arduino.cc/ 12. https://www.raspberrypi.com/documentation/computers/remote-access.html
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

Course Outcomes	**At the end of the course the student will be able to:** 1. Explain characteristics of Embedded System design [L2] 2. Acquire knowledge about basic concepts of circuit emulators, debugging and RTOS [L2] 3. Analyse embedded system software and hardware requirements. [L3] 4. Develop programming skills in embedded systems for various applications [L4] 5. Design basic embedded system for real time applications.[L4]

Assessment Details (both CIE and SEE)

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) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures 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.

Continuous Internal Evaluation (CIE):

For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.

- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment. Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

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Semester End Evaluation (SEE):
Semester-End Examination: Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours).
1. The question paper will have ten questions. Each question is set for 20 marks.
2. 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.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks.

The Correlation of Course Outcomes (CO's) and Program Outcomes (PO's)

Course Code:	BEE613B	TITLE: Embedded Systems Design							Faculty Member: SHREESHAYANA R		
List of Course Outcomes	Program Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO-1	3	3	-	-	2	-	-	-	-	-	-	2
CO-2	3	3	-	-	2	-	-	-	-	-	-	2
CO-3	3	3	2	-	2	-	-	-	-	-	-	2
CO-4	3	3	2	-	2	-	-	-	-	-	-	2
CO-5	3	3	2	-	2	-	-	-	-	-	-	2

Note: 3 = Strong Contribution 2 = Average Contribution 1= Weak Contribution - = No Contribution

The Correlation of Course Outcomes (CO's) and Program Specific Outcomes (PSO's)

Course Code:	BEE613B	TITLE: Embedded Systems Design	Faculty Member: SHREESHAYANA R
List of Course Outcomes	Program Specific Outcomes		
	PSO1		PSO2
CO-1	-		3
CO-2	-		3
CO-3	-		3
CO-4	-		3
CO-5	-		3

Note: 3 = Strong Contribution 2 = Average Contribution 1 = Weak Contribution - = No Contribution