Academic Course Description

BHARATH UNIVERSITY
Faculty of Engineering and Technology
Department of Electronics and Communication Engineering

BEI605 – EMBEDDED SYSTEM DESIGN

Sixth Semester, 2016-17 (Even Semester)

Course (catalog) description

Embedded system design is a required course for under-graduate students in the ECE program. The purpose of this course is to teach students the fundamentals of embedded systems. Topics include Embedded Design With Microcontrollers, Partitioning Decision, Functionalities for System Design, Circuit Emulators and Embedded Design Life Cycle & Testing

Compulsory/Elective course : Elective course

Credit & contact hours : 3 & 45

Course Coordinator : Ms.S.Philomina, Assoc. Professor.

Instructor(s) :

Name of the instructor	Class handling	Office location	Office phone	Email (domain: @bharathuniv.ac.in)	Consultation
S.Philomina	III YEAR			philomina.ece	12.30 - 1.30 PM
Ms K.Subbulakshmi	III YEAR			Subbulakshmi.ece	12.30 - 1.30 PM

Relationship to other courses

Pre-requisites : Microprocessor and Microcontroller.

Assumed knowledge : Basic knowledge in Microprocessor and Microcontroller and Computer architecture.

Following Courses : Nil

UNIT 1 EMBEDDED DESIGN WITH MICROCONTROLLERS 9 HOURS

Product specification – Hardware / Software partitioning – Detailed hardware and software design – Integration – Product testing – Microprocessor Vs Micro Controller – Performance tools– RTOS Micro Controller -issues in selection of processors.

UNIT 2 PARTITIONING DECISION 9 HOURS

Hardware / Software duality – Hardware-Software partitioning- coding for Hardware- software development – ASIC revolution – Managing the Risk – Co-verification – execution environment – memory organization –memory enhancement – Firmware-speed and code density -System startup.

UNIT 3 FUNCTIONALITIES FOR SYSTEM DESIGN **9 HOURS**

Timers, Watch dog timers – RAM, Flash Memory basic toolset – Integration of Hardware & Firmware- in System Programming, in Application Programming, IDE-Target Configuration- Host based debugging – Remote debugging – ROM emulators – Logic analyzer.

UNIT 4 CIRCUIT EMULATORS **9 HOURS**

Bullet proof run control – Real time trace – Hardware break points – Overlay memory – Timing constraints – Usage issues – Triggers.

UNIT 5 EMBEDDED DESIGN LIFE CYCLE & TESTING **9 HOURS**

Objective, Need, different Phases & Modeling of the EDLC, choice of Target Architectures for Embedded Application Development-for Control Dominated-Data Dominated Systems- Software &Hardware Design, PCB Design, Manufacturing & PCB Assembly-Bug tracking – reduction of risks & costs – Performance – Unit testing – Regression testing – Choosing test cases – Functional tests – Coverage tests – Testing embedded software – Performance testing – Maintenance.

TOTAL 45 HOURS

Text book(s) and/or required materials

Text Books:

1. James K.Peckol, "Embedded system Design", John Wiley & Sons, 2010

Reference:

1. Elicia White, "Making Embedded Systems", O'Reilly Series, SPD, 2011
2. Rajkamal,"Embedded Systems", TMH, 2009.
3. Lyla B Das," Embedded Systems-An Integrated Approach", Pearson2013 5. Arnold S. Berger – "Embedded System Design", CMP books, USA 2002
4. Michael Barr, Anthony Massa "Programming Embedded Systems: With C and GNU Development Tools", O' Reilly, 2007 USA

Computer usage:

Students are expected to use the computer to write and assemble assembly language programs and also run them by downloading them to the target microprocessor.

Professional component

General	-	0%
Basic Sciences	-	0%
Engineering sciences & Technical arts	-	0%
Professional subject	-	100%

Broad area : Communication | Signal Processing | Electronics | VLSI | **Embedded**

Test Schedule

S. No.	Test	Tentative Date	Portions	Duration
1	Cycle Test-1	February 2nd week	Session 1 to 14	2 Periods
2	Cycle Test-2	march 2nd week	Session 15 to 28	2 Periods

3	Model Test	April 3rd week	Session 1 to 45	3 Hrs
4	University Examination	TBA	All sessions / Units	3 Hrs.

Mapping of Instructional Objectives with Program Outcome

The scope of this course is to introduce the Building Blocks of Embedded System, to Educate in Various Embedded Development Strategies, to Introduce Bus Communication in processors, Input/output interfacing, to impart knowledge in various processor scheduling algorithms and to introduce Basics of Real time operating system and example tutorials to discuss on one real time operating system tool This course emphasizes:	**Correlates to program outcome**		
	H	**M**	**L**
1. Acquire a basic knowledge about fundamentals of microcontrollers	a, c, b	e,j,d	h
2. Acquire a basic knowledge about programming and system control to perform a specific task.	a, c, b	e,j,d	h
3. Acquire knowledge about devices and buses used in embedded networking	a, c, b	e,j,d	h
4. Develop programming skills in embedded systems for various applications.	a, c, b	e,j,d	h
5. Acquire knowledge about basic concepts of circuit emulators.	a, c, b	e,j,d	h
6. Acquire knowledge about Life cycle of embedded design and its testing.	a, c, b	e,j,d i	h

H: high correlation, M: medium correlation, L: low correlation

Draft Lecture Schedule

Session	Topics	Problem Solving (Yes/No)	Text / Chapter
UNIT-I - EMBEDDED DESIGN WITH MICROCONTROLLERS			
1	Product specification	No	R2/C1
2	Hardware / Software partitioning	No	R2/C1
3	Detailed hardware and software design	No	R2/C1
4	Integration	No	R2/C1
5	Product testing	No	R2/C1
6	Microprocessor Vs Micro Controller	No	R2/C1
7	Performance tools	No	R2/C1
8	RTOS Micro Controller	No	T1/C11
9	issues in selection of processors	No	R2/C1
UNIT-II- PARTITIONING DECISION			
10	Hardware duality	No	R1/C3
11	Software duality	No	R1/C3
12	Hardware/ Software partitioning	No	R1/C3
13	Coding for Hardware/software development	No	R1/C3
14	ASIC revolution	No	R2/C1
15	Managing the Risk, Co-verification execution environment	No	R2/C1

16	memory organization, memory enhancement	No	R2/C2
17	Firmware-speed and code density	No	R2/C1
18	System startup	No	R2/C1
UNIT - III- FUNCTIONALITIES FOR SYSTEM DESIGN			
19	Timers, Watch dog timers	No	T1/C4
20	RAM, Flash Memory basic toolset	No	T1/C4
21	Integration of Hardware & Firmware	No	T1/C4
22	In System Programming	No	T1/C4
23	In Application Programming	No	T1/C4
24	IDE, Target Configuration	No	T1/C4,R3/C6
25	Host based debugging	No	T1/C4
26	Remote debugging – ROM emulators	No	T1/C4
27	Logic analyzer	No	T1/C4
UNIT -IV- CIRCUIT EMULATORS			
	Bullet proof run control	No	R4/C5
29	Real time trace	No	R4/C5
30	Hardware break points	No	R4/C5
31	Overlay memory	No	R4/C7
32	Timing constraints	No	R4/C5
33	Usage issues	No	R4/C5
34	Triggers	No	R4/C5
UNIT-V- EMBEDDED DESIGN LIFE CYCLE & TESTING			
35	Objective, Need, different Phases & Modeling of the EDLC	No	R3/C17
36	choice of Target Architectures for Embedded Application Development-for Control Dominated systems	No	R3/C17
37	choice of Target Architectures for Embedded Application Development-for Data Dominated Systems	No	R3/C17
38	Software &Hardware Design	No	R3/C17
39	PCB Design, Manufacturing & PCB Assembly	No	R3/C17
40	Bug tracking – reduction of risks & costs – Performance	No	R3/C17
41	Unit testing – Regression testing	No	R3/C17
42	Choosing test cases – Functional tests – Coverage tests	No	R3/C17
43	Testing embedded software	No	R3/C17
44	Performance testing	No	R3/C17
45	Maintenance	No	R3/C17

Teaching Strategies

The teaching in this course aims at establishing a good fundamental understanding of the areas covered using:

- Formal face-to-face lectures
- Laboratory sessions, which support the formal lecture material and also provide the student with practical construction, measurement and debugging skills.

- Small periodic quizzes, to enable you to assess your understanding of the concepts.

Evaluation Strategies

Cycle Test – I	-	5%
Cycle Test – II	-	5%
Model Test	-	10%
Assignment /Seminar/online test/quiz	-	5%
Attendance	-	5%
Final exam	-	70%

Prepared by : S.Philomina, Assoc Professor. **Dated :**

Addendum

ABET Outcomes expected of graduates of B.Tech / ECE / program by the time that they graduate*:*

a. An ability to apply knowledge of mathematics, science, and engineering

b. An ability to design and conduct experiments, as well as to analyze and interpret data

c. An ability to design a hardware and software system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

d. An ability to function on multidisciplinary teams

e. An ability to identify, formulate, and solve engineering problems

f. An understanding of professional and ethical responsibility

g. An ability to communicate effectively

h. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context

i. A recognition of the need for, and an ability to engage in life-long learning

j. A knowledge of contemporary issues

k. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Program Educational Objectives

PEO1: PREPARATION

Electronics Engineering graduates are provided with a strong foundation to passionately apply the fundamental principles of mathematics, science, and engineering knowledge to solve technical problems and also to combine fundamental knowledge of engineering principles with modern techniques to solve realistic, unstructured problems that arise in the field of Engineering and non-engineering efficiently and cost effectively.

PEO2: CORE COMPETENCE

Electronics engineering graduates have proficiency to enhance the skills and experience to apply their engineering knowledge, critical thinking and problem solving abilities in professional engineering practice for a wide variety of technical applications, including the design and usage of modern tools for improvement in the field of Electronics and Communication Engineering.

PEO3: PROFESSIONALISM

Electronics Engineering Graduates will be expected to pursue life-long learning by successfully participating in post graduate or any other professional program for continuous improvement which is a requisite for a successful engineer to become a leader in the work force or educational sector.

PEO4: SKILL

Electronics Engineering Graduates will become skilled in soft skills such as proficiency in many languages, technical communication, verbal, logical, analytical, comprehension, team building, interpersonal relationship, group discussion and leadership ability to become a better professional.

PEO5: ETHICS

Electronics Engineering Graduates are morally boosted to make decisions that are ethical, safe and environmentally-responsible and also to innovate continuously for societal improvement.

Course Teacher	Signature
Ms S.PHILOMINA	
Ms K.Subbulakshmi	

Course Coordinator **HOD/ECE**