Kingdom of Saudi Arabia Ministry of Higher Education Qassim University College of Engineering		المملكة العربية السعودية وزارة التعليم العالي جامعة القصيم كليه الهندسه

Systems on Chip Design

College: Engineering

Department: Electrical

First: Course Definition, a Summary:

1- Course Code: EE 619

2- Units: 3 credit hrs

3- Level: 3rd

4- Prerequisite: Basic knowledge of microprocessor/microcontroller architecture, programming is required

5- Co-requisite:

6- Location (if not on main Campus):

Second: Course Objectives

- Give students an appreciation of the understanding of technological advances that allow us to integrate complete multi-processor systems on a single die, Systems-on-Chip (SoCs) are at the core of most embedded computing and consumer devices, such as cell phones, media players and automotive, aerospace or medical electronics.
- To make students familiar with the concepts, issues, and process of designing highly integrated SoCs following systematic hardware/software co-design & co-verification principles.
- Specifically, the class project involves FPGA prototyping platform using state-of-the-art synthesis and verification tools and design flows.

Third: Course Description

1- Topics to be covered

Subject	No of Weeks	Units

• System-level and SoC design methodologies and tools	٢	6
• HW/SW co-design: analysis, partitioning, real-time scheduling, hardware acceleration, SoC bus architecture (Standard buses, Network-on-Chip)	2	6
• Virtual platform models, co-simulation and FPGAs for prototyping of HW/SW systems	2	6
Transaction-Level Modeling (TLM), Electronic System-Level (ESL) languages: VHDL, Verilog, System	3	9
• High-Level Synthesis (HLS): allocation, scheduling, binding, resource sharing, pipelining	2	6
• SoC and IP integration, verification and test (Automatic test pattern generation, Scan test fundamentals, Memory test fundamentals)	2	6
• Low Power Design (System, RTL, Circuit & Gate Level) • Reuse IP, SoC bus architecture	2	6

2- Course components (Total hrs in the Semester: 60

Lectures	Exercises	Other
45	15	----

3- Intended Learning Outcomes of the Course (ILO's)

a. *Knowledge*

i) Description of the knowledge to be acquired:

- SoC Design Methodologies
- Hardware/Software Codesign methods
- SoC & IP integration techniques

ii) Teaching strategies to be used to develop that knowledge

- Class lectures
- Students' presentations
- Group discussion in the Class
- Assignments
- Case study Report (data collection, internet search, and reporting

iii) Methods of assessment of knowledge acquired

- Exams
- Quizzes
- Homework assignments
- Term projects

b- Cognitive (Intellectual) Skills

i) Cognitive skills to be developed

- The ability to understand SoC methodologies
- Ability to analyze the Hardware/Software codesign
- Ability to understand SoC & IP integration

ii) Teaching strategies to be used to develop these cognitive skills

- Class lectures
- Case studies analysis
- Term projects

iii) Methods of assessment of students' cognitive skills

- Students' seminars and presentations
- Term projects
- Written reports

c. Interpersonal Skills and Responsibility

i) Description of the interpersonal skills and capacity to carry responsibility to be developed

- Decision making based on engineering analysis
- Communication skills
- Team work

ii) Teaching strategies to be used to develop these skills

- Reports
- Term team projects
- Presentations and seminars

iii) Methods of assessment of students' interpersonal skills and capacity to carry responsibility

- *Evaluation of the team* projects
- Written reports
- Students' seminars and presentations

d. Communication, Information Technology and Numerical Skills

i) Description of the skills to be developed in this domain

- Literature search
- Problems numerical modelling
- Utilization of computer applications in analysis and design

ii) Teaching strategies to be used to develop these skills

- Class lectures
- Case studies analysis
- Computer lab sessions
- Term projects

iii) Methods of assessment of students numerical and communication skills

- Term projects
- Written reports
- Students' seminars and presentations

e. Psychomotor (if applicable) & Other Non-cognitive Skills

i) Description of the psychomotor or other skills to be developed and the level of performance required

- NA

ii) Teaching strategies to be used to develop these skills-

- NA

iii) Methods of assessment of student's psychomotor skills

- NA

4- Student Assessment Schedule

Serial	*Assessment tool (test, group project, examination etc.)*	*Week due*	*Weight*
1	Term Project	3rd	30 %
2	Mid Term Exam -1	7th	20 %
5	Final Exam	16th	50 %

5- Student Support

- Providing electronic library for references and scientific periodicals. Students have access to the ieeeXplore and ScienceDirect digital libraries of the IEEE and Elsevier respectively
- Providing the necessary computer applications for the course.

6- Learning Resources

i) Essential Books (References)

- SoC Design Methodologies, Robert, M.; Rouzeyre, B.; Piguet, C.; Flottes, Springer publishers
- Embedded System Design – A Unified Hardware/Software Introduction by Frank Vahid and Tony Givargis, Wiley, 2002, ISBN: 0-471-38678-2
- Reuse methodology manual for system-on-a-chip designs by Michael Keating and Pierre Bricaud, 1998, Kluwer Academic Publishers, ISBN: 0-7923-8175-0.
- Co-Verification of Hardware and Software for ARM SOC Design, Jason, R. Andrews, Elsevier Inc. 2005, ISBN: 0-7506-7730-9
- Digital IC Design Flow Tutorial V1.0, CMC Microsystems, 2004

ii) Course Notes Course materials are uploaded on the College Web-Site (www.qec.edu.sa) to be available for the students.

iii) Recommended Books

- Modern VLSI Design: System-on-Chip Design (3rd Edition), Wayne Wolf
- Modern VLIS Design: IP-based Design (4th Edition), Wayne Wolf

iv) Electronic Books & Web Sites:

- Scientific journals and forums.

Students have access to the ieeeXplore and ScienceDirect digital libraries of the IEEE and ElSevier respectively

v) Periodicals

-IEEE and Elservier Journals

7- Course Evaluation and Improvement Processes

i) Strategies for Obtaining Student Feedback on Effectiveness of Teaching

- Students' Questionnaires
- Observing the students opinions recorded in the college student site
- Appeal box

- Carrying out extensive questioners by a sample of the distinguished students just after the graduation from the college

ii) Other Strategies for Evaluation of Teaching by the Instructor or by the Department

- Instructor report
- Public faculty seminars
- Periodical review of the teaching methods by both the department council and the education affairs vice dean

iii) Processes for Improvement of Teaching

- Assessment of students' work by external examiners
- Analysis of students' evaluation of course and instructor
- Seminars by industry professionals
- Evaluation of the course outlines and student works by external staff member
- Periodical contact with different engineering authorities and industries for evaluating and getting their feedback and suggestions concerning the course outlines

iv) Processes for verifying standards of student achievement

- Check marking by an independent faculty member of a sample of student work
- Periodic exchange and remarking of a sample of assignments/exams with a external evaluator

v) Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement.

- Assessment and evaluation of the level of achieving the course outcomes through a continuous improvement process (part of a quality assurance system established by the university)
- Consequently, actions are to be taken to improve the course delivery when necessary
- Review of the course objectives, outcomes and curriculum every 2 years