

# Rules and Regulations for PhD Qualifying Exam in Computer Engineering Department (Updated: Nov. 2, 2018)

- I. The PhD Qualifying Exam consists of a written part and an oral part.
- II. The Written part of the Exam consists of two sub-parts (A & B):

A. **CORE (MATH + THEORY or SYSTEMS):**

**MATHEMATICS:**

|          |  |
|----------|--|
| MATH 163 | Discrete Mathematics                               |
| MATH 241 | Linear Algebra and Ordinary Differential Equations |
| MATH 322 | Probability and Statistics                         |
| MATH 373 | Numerical Analysis for Engineers                   |

**THEORY:**

|                   |  |
|-------------------|--|
| CMPE318           | Programming Language Design                |
| CMPE231 + CMPE371 | (Data Structures + Analysis of Algorithms) |
| CMPE471           | Automata Theory                            |

**SYSTEMS:**

|                   |   |
|-------------------|---|
| CMPE224 + CMPE324 | (Digital logic Systems + Computer Architecture) |
| CMPE242           | Operating Systems                               |
| CMPE344           | Computer Networks                               |

B. **SPECIALIZATIONS (One of the following 4 fields)**

**B1- NETWORKS AND SYSTEMS**

- a. Data Networks (Layering, switching, point-to-point protocols, multiple access, routing, flow control, wireless networks)
- b. Performance Analysis (Markov chains, queuing theory, fluid models, rate control, bounds, effective capacity)
- c. Simulation (Random variable generation, discrete event simulation, statistical analysis and validation, variance reduction, Markov chain Monte Carlo methods)

B1 - Related graduate coursework:

CMPE 516 (3,0) 3 Advanced Topics in Microprocessors  
CMPE 521 (3,0) 3 Advanced Computer Architecture  
CMPE 541 (3,0) 3 Network and Distributed Systems  
CMPE 542 (3,0) 3 Advanced Networking  
CMPE 543 (3,0) 3 Randomized Algorithms  
CMPE 545 (3,0) 3 Broadband Networks  
CMPE 547 (3,0) 3 Queuing Networks for Computer Applications  
CMPE 548 (3,0) 3 Analysis of Computer Communication Networks  
CMPE 549 (3,0) 3 Personal Wireless Communication  
CMPE 576 (3,0) 3 Advanced Systems Simulation

**B2 – DISTRIBUTED SYSTEMS AND PROGRAMMING**

- a. Distributed Systems
- b. Programming languages
- c. Parallel programming

B2 - Related graduate coursework:

CMPE 522 (3,0) 3 Distributed Shared Memory Multiprocessing  
CMPE 523 (3,0) 3 Parallel and Distributed Programming  
CMPE 543 (3,0) 3 Operating Systems theory  
CMPE 576 (3,0) 3 Advanced System Simulation  
CMPE 581 (3,0) 3 Modeling Multimedia Systems  
CMPE 582 (3,0) 3 Object Oriented Programming and Graphical User Interfaces in Java  
CMPE 583 (3,0) 3 Web Semantics

**B3 – INFORMATION SYSTEMS**

- a. Databases – Cryptography and security
- b. Logic and Logic Programming
- c. Fuzzy Systems

B3 - Related graduate coursework:

CMPE 531 (3,0) 3 Logic Programming  
CMPE 532 (3,0) 3 Constraint Programming  
CMPE 534 (3,0) 3 Automated Deduction  
CMPE 535 (3,0) 3 Knowledge Engineering  
CMPE 537 (3,0) 3 Evolutionary Neuro-Fuzzy Systems  
CMPE 552 (3,0) 3 Database and File Security

CMPE 553 (3,0) 3 Cryptography and Network Security  
CMPE 554 (3,0) 3 Natural Language Processing  
CMPE 556 (3,0) 3 Information Retrieval  
CMPE 558 (3,0) 3 Data Mining  
CMPE 564 (3,0) 3 Ensemble Learning  
CMPE 572 (3,0) 3 Digital Forensics  
CMPE 586 (3,0) 3 Software Implementation of Fuzzy Systems

#### **B4 – COMPUTATIONAL INTELLIGENCE**

- a. Linear and Nonlinear Programming (problem formulation and **derivative-based** solution techniques )
- b. Meta-heuristic Algorithms (**derivative-free** learning techniques including genetic methods, taboo search and neural networks)
- c. Machine Learning Techniques (pattern recognition, NLP, AI)

#### **B4 - Related graduate coursework:**

CMPE 528 (3,0) 3 Computational Principles of Robotics  
CMPE 532 (3,0) 3 Constraint Programming  
CMPE 533 (3,0) 3 Artificial Intelligence  
CMPE 535 (3,0) 3 Knowledge Engineering  
CMPE 537 (3,0) 3 Evolutionary Neuro-Fuzzy Systems  
CMPE 536 (3,0) 3 Meta-heuristics  
CMPE 538 (3,0) 3 Evolutionary Multi-Objective Optimization  
CMPE 539 (3,0) 3 Multiagent Systems  
CMPE 543 (3,0) 3 Randomized Algorithms  
CMPE 554 (3,0) 3 Natural Language Processing  
CMPE 556 (3,0) 3 Information Retrieval  
CMPE 558 (3,0) 3 Data Mining  
CMPE 561 (3,0) 3 Neural Networks  
CMPE 562 (3,0) 3 Pattern Recognition  
CMPE 564 (3,0) 3 Ensemble Learning  
CMPE 572 (3,0) 3 Digital Forensics  
CMPE 573 (3,0) 3 Computer Vision  
CMPE 574 (3,0) 3 Biometrics  
CMPE 584 (3,0) 3 Evolutionary Computation and Programming  
CMPE 586 (3,0) 3 Software Implementation of Fuzzy systems

**Note:** It is the responsibility of the student and his/her supervisor to choose a specialization group at the beginning of the PhD study. However only if not enough number of courses are offered from a group during the student's course-taking-period, the missing courses will be selected by the thesis supervisor.

### **III. GRADING POLICY AND PASSING GRADE**

#### **Grading Policy:**

- A) There will be 5 questions from CORE courses (2 from Math courses + 3 from Theory or Systems)
- B) There will be 4 questions from SPECIALIZATION courses

#### **Passing Grade:**

The following logic will be used to determine the passing grade:

**IF** the candidate gets an average of (60/100 **OR** above from Core courses) **AND** (70/100 **OR** above from Specialization courses) **THEN**

**IF** the candidate gets an overall grade  $\geq 65$  (0.4 times Core courses average grade + 0.4 times Specialization courses average grade + 0.2 times Oral part average grade) **THEN**

**PASS**

Else, **FAIL**

In case of failing, the student will repeat the exam in the next semester and will be responsible from all parts.