

BLG 231E Digital Circuits

Fall 2022

	CRN: 12625	CRN: 12626
Instructors:	Feza Buzluca http://akademi.itu.edu.tr/buzluca buzluca@itu.edu.tr EEB 4318	Sanem Kabadayı http://web.itu.edu.tr/kabadayi kabadayi@itu.edu.tr EEB 3311
Classrooms:	EEB 4102	EEB 5104
TAs: (both sections)	Esin Ece Aydın Büşranur Bülbül aydinesi16 bulbulb17 @itu.edu.tr @itu.edu.tr	Kıymet Kaya Mert Sülük kayak16 suluk20 @itu.edu.tr @itu.edu.tr

Course site: <http://ninova.itu.edu.tr>

Course time and location: Friday 8:30-11:30 AM, EEB 4102 - EEB 5104 (depending on section, check the table above)

Students **must attend the section for which they have officially registered**. Please check your actual section by logging into <https://www.sis.itu.edu.tr>.

Description: Boolean algebra, binary numbers, combinational logic design, synchronous sequential circuit analysis and synthesis.

Required texts:

- *Digital Design: Principles and Practices*, John F. Wakerly, Pearson, 2018. 5th ed.
- *Digital Design*, M. Morris R. Mano and Michael D. Ciletti, Pearson, 2018. 6th ed.

For each lecture, you should read the relevant sections in the lecture slides as listed in the weekly course schedule on the last page of this syllabus.

Homework (Take-home exams): There will be five homework assignments (5 x Take-home exams). You are expected to make an honest, independent attempt to solve and turn in your answers to each homework question. Digital circuits can only be mastered by solving problems, not just by listening to a lecturer. Therefore, doing the homework assignments is crucial to performing well in this class. If you are having considerable difficulty with the early assignments, this is a sign that you may be in over your head - you should contact us immediately. We can help you understand the parts you are confused about. The only way to pass the course is to work hard and get sufficient grades in exams and assignments. Do not contact us at the end of the semester to negotiate a better grade. The assignments will require a substantial time commitment over several days (several hours per week outside of class should be expected). Be sure to budget sufficient time to complete assignments before the deadline. You may not copy solutions from a classmate or from the Internet. This is considered cheating! Homework is individual. There are no group assignments in this course.

Attendance: It is imperative that you attend the lectures and pay attention. You are not allowed to work on your laptop or read anything not related to the class during the lecture. You must attend the section for which you have officially registered. Please check your actual section by logging into <https://www.sis.itu.edu.tr>. You are required to attend 70% of the lectures in order to be allowed to take the final exam. (Since this semester has 14 weeks, you have to attend at least 10 lectures). Those who do not meet the attendance requirement will fail the course with a grade of VF (Article 23, Undergraduate Education Regulations, <https://www.sis.itu.edu.tr/TR/mevzuat/lisans-yonetmelik.php>). Note that the 70% attendance rule still applies **even if** you have taken this course before. There are NO exceptions. Attendance may be taken at any point in the lecture. No additions can be made to the attendance list after that point. If you

do miss class, it is your responsibility to find out (from a classmate) what you missed, including class notes, announcements, and worksheets. No make-up exams will be given. Absences from the midterm or final will result in a grade of zero for that exam. Check the exam dates and make sure you will be able to attend class on exam dates. The midterm will be on **Friday, November 4, 2022** in class (if exam rooms cannot be allocated for use during class time, the exam will be given in the late afternoon).

Evaluation: The distribution of percentages for the course grade will be as follows:

Homework (5 take-home exams)	25 %
Midterm	35 %
Final	40 %

Course grade: Your grade for this course will be determined by your scores on the midterm, homework, and the final, not by any external circumstances which you think are “special” or “unique.” There are no subjective criteria in this course. The exams and homework are graded based on the same objective rubrics for all students. The partial credit you receive on exam questions is at the sole discretion of the course instructors and assigned consistently across all students based on specific criteria. In case it is not already obvious, your grade in this course, or any course for that matter, is solely your own responsibility.

Eligibility to take the final exam: Students must meet the following criteria to take the final exam:

- Students must attend 70% of lectures.
- Students must have a mid-semester average grade of at least 35/100.

The average mid-semester grade is computed using the formula below:

$$\text{Avg. mid-semester grade} = (0.25 \times \text{Assign.} + 0.35 \times \text{Midterm}) \times 100 / 60$$

Any student who gets a grade lower than the required grade on any of these assessments will fail the course with a grade of VF and not be allowed to take the final exam.

Announcements on course site and by e-mail: You are expected to check the Ninova web site and your ITU e-mail for homework and announcements. In addition, you are responsible for all announcements that may be made on the course web site and in class (that may or may not be included in this syllabus).

E-mail etiquette: Your full name must appear in the e-mail. Please include your name in the “From:” line of the email message, not just your email address. To add your name to your ITU mail account, log into ITU Webmail. Hover over the cog (gear) icon at the center of the top banner of Webmail (to the right of “Yardım”). Choose “Preferences → Global Preferences.” Under “Personal Information,” in the “Your full name:” field, enter your full name. Click “Save.”

The e-mail subject must be “BLG 231E”. Do not send the same e-mail repeatedly. Your e-mails may be in English or Turkish. Regardless of which language you use, use proper grammar, lower-case/uppercase letters, and punctuation. Your e-mails should not look like chat messages. Although it is easy for you to dash off an email question, be aware that it takes time to answer it.

Academic honesty: You are expected to read the Undergraduate Education Regulations (<https://www.sis.itu.edu.tr/TR/mevzuat/lisans-yonetmelik.php>) and ITU Academic Honesty Pledge (<https://www.sis.itu.edu.tr/TR/mevzuat/akademik-onur-sozu-esaslar.php>) and behave accordingly. Cheating on the exams or on homework will result in disciplinary action. Every piece of work that you turn in with your name on it must be yours and yours alone. No coworking is allowed on any test or homework. You must not turn in work that is not yours.

Specifically, you are not allowed to copy someone else's homework. This is plagiarism. You must not enable someone else to turn in work that is not his or hers. Do not share your work with anyone else.

Final: The final exam will be given during the final exam period (January 2-15, 2023), at the time and location determined by the University.

Where does this course fit in? This course is a prerequisite for BLG 242E Logic Circuits Lab (http://ssb.sis.itu.edu.tr:9000/pls/PROD/itu_icerik.p_download?file=BLG242E), BLG 212E Microprocessor Systems (http://ssb.sis.itu.edu.tr:9000/pls/PROD/itu_icerik.p_download?file=BLG212E) and BLG 222E Computer Organization (http://ssb.sis.itu.edu.tr:9000/pls/PROD/itu_icerik.p_download?file=BLG222E), which are required courses.

Tentative course schedule (subject to change):

	Date	Subject	Slides
1	23-Sep	Rules Intro.: dig. sys., num. systems, bin. codes, number rep., bin. arithmetic	0.1-0.4 1.1-1.29
2	30-Sep	Boolean algebra: basic operations, Boolean expressions, truth tables, law&theorems of Bool. algebra, simplifying an expression, order relations	2.1-2.19
3	7-Oct	Logic functions and their representations, forms (minterms/maxterms) Boolean cubes, Karnaugh maps, canonical forms	2.20-2.48
4	14-Oct	Logic gates: positive/negative logic, impl. of Bool. func. using gates, functional completeness, universal gates, implement. using NAND&NOR	3.1-3.19
5	21-Oct	Minimization of logic functions: literals, implicants, prime implicants	4.1-4.8
6	28-Oct	Minim. of logic func.: Essential/sufficient prime impl., prime impl. chart, incomplete functions, don't cares, general functions, Quine-McCluskey	4.9-4.37
7	4-Nov	Recitation & MIDTERM EXAM	
8	18-Nov	ICs: half adder, full adder, subtraction, multiplexers, demultiplexers, decoders	5.1-5.22
9	25-Nov	ICs: programmable logic devices (PLDs): PLAs, PALs, FPGAs Timing: Timing diagrams, propagation delays, and hazards Sequential circuits: FSM, memory units, T flip-flop	5.23-5.38 6.1-6.6 7.1-7.8
10	2-Dec	Sequential circuits: feedback connections, bistable circuits, S-R latch, D latch, D flip-flop	7.9-7.28
11	9-Dec	Sequential circuits: J-K latch and flip-flop, characteristic equations, registers Clocked synch. seq. circuits: Mealy & Moore, analysis of Mealy seq. circuits	7.28-7.38 8.1-8.10
12	16-Jan	Clocked synch. seq. circuits: analysis of Moore seq. circuits, role of clock Design of synch. sequential circuits: Synch. circuit design using J-K FF's	8.10-8.19 9.1-9.14
13	23-Jan	Design of synch. seq. circuits: multiplexers, counter design, impl. using PLD Internal struct.: BJT, TTL (logic levels, fanout)	9.15-9.23 10.1-10.11
14	30-Jan	Internal struct.: CMOS (NOT, NAND, NOR), three-state buffer, three-state common bus, logic levels	10.12-10.20
	2-Jan - 15-Jan	Final (Tentative)	

Last day for add/drop: The add/drop period ends on Friday, September 23, 2022. You may withdraw from the course between September 26, 2022 and September 30, 2022. There is no way to drop or withdraw from a course after September 30, 2022!

Announcement of letter grades: The Academic Calendar lists January 22, 2023 (12 PM) as the deadline for the submission of final letter grades.