COSC130
Computer Organization & Architecture
SYLLABUS

Summer 2019 Course Description
Number systems, Boolean algebra, combinational and sequential circuits, registers, processor functional units and control, pipelining, memory and caching, stored program computing, memory management, computer system organization, and assembly language programming.

Contact Hour Distribution: 3 hours lecture and 1 lab.
Grading Restriction: A, B, C, No Credit grading only.
(RE) Prerequisite(s): 102.
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I. General Information

1.1. Purpose. This syllabus describes the COSC130 course, policies, and procedures. This syllabus is mandatory for all students enrolled in COSC130.

1.2. Scope. This syllabus applies to all students enrolled in the COSC130 course at the Min H. Kao Department of Electrical Engineering and Computer Science (http://www.eecs.utk.edu) of the Tickle College of Engineering (http://tickle.utk.edu) of the University of Tennessee (http://www.utk.edu).

1.3. Amendments. Amendments may be made to this syllabus with or without notification; therefore, do NOT save this syllabus. Instead, retrieve it from Canvas every time in case it happens to update. Use the date at the lower-right corner of the syllabus to determine if you’re reading the most up-to-date version. A summary of changes will be provided on the syllabus.

1.3.1. Exceptions. Topics, office hours, and TAs may be updated without additional approval this syllabus.

1.4. Current Version. The most current version of this syllabus may be downloaded at: http://tiny.utk.edu/cosc130.

1.5. Key Words.

1.5.1. "Will", "must", and "shall" indicate a mandatory requirement.

1.5.2. "Should" is used to indicate a preferred, but not mandatory, method.

1.5.3. "May" indicates an acceptable or suggested means.

1.5.4. “UTK” is short for the “University of Tennessee at Knoxville”.

1.5.5. “TBD” is short for “To Be Determined”.

1.5.6. “IAW” is short for “In Accordance With”.

1.6. Learning Management System. All students will be required to use Canvas as the learning management system. The current link to Canvas can be found at: https://tiny.utk.edu/canvas_cosc130.

1.6.1. Calendar. The Canvas calendar will be used to notify any class cancellations for any purpose, including holidays. Students will be required to frequently check their Canvas calendar for due dates and class dates.

1.7. Times and Dates. All times and dates, including due dates, will use the Eastern Time Zone and will observe spring and fall time changes (EST and EDT). Furthermore, all times will use a 24-hour clock (e.g., 1100 = 11:00am, 1200 = 12:00pm, 1500 = 3:00pm, 1800 = 6:00pm, 2200 = 10:00pm, etc.).

1.8. Student Information and Accommodations. All student information will be kept confidential in accordance with the Family Educational Rights and Privacy Act of 1974 (FERPA). More information may be found at: https://ferpa.utk.edu.
1.8.1. **FERPA Waiver.** Students may waive some or all their FERPA rights, typically in cases such as letters of recommendations. Students must complete and sign a FERPA form before any FERPA-related information is released.

1.8.2. **Disclosure.** All student information is covered under FERPA and will not be disclosed to anyone, including students' parents. FERPA information necessary for this course is retrievable by the professors, undergraduate teaching assistants, and graduate teaching assistants.

1.8.3. **Disability.** Any students who have disabilities may register with the Office of Student Disability Services (SDS) for a range of accommodations. No accommodations will be made without prior approval from SDS.

1.8.3.1. **SDS Website.** More information about SDS may be found at: [https://sds.utk.edu](https://sds.utk.edu).

1.9. Deviations.

1.9.1. While compliance with this syllabus is mandatory, the following exceptions to policy may be made given:

   1.9.1.1. All exception to policy rules must be in writing (unless otherwise noted), or
   1.9.1.2. Exceptions to policy rules must be made at the department head level, or
   1.9.1.3. Any illness, injury, death in the family, and so forth requires an "absence request" from the Dean of Students ([https://dos.utk.edu](https://dos.utk.edu)).

1.9.2. For unusual circumstances, the professor or instructor may deviate from this syllabus on a case-by-case basis.

   1.9.2.1. TAs and other representatives of this course may suggest deviations, but they are not permitted to approve deviations and must comply with 1.9.1 above.

1.10. **Teaching Assistants (TA).** Teaching assistants are representatives of the COSC130 professors. They have full access to all student information, including grades. Teaching assistants may be undergraduate (UTA) or graduate students (GTA), or both.

1.11. **Supplemental Instructors (SI).** Supplemental instructors from the student success center are not official representatives of the COSC130 course.

   1.11.1. Students will not consider any instruction or suggestion to be official from any supplemental instructor.

   1.11.2. Supplemental instructors must not make any deviations per section 1.9 of this syllabus.

   1.11.3. Information about the SI program is available at: [https://studentsuccess.utk.edu/supplemental-instruction/what-is-supplemental-instruction](https://studentsuccess.utk.edu/supplemental-instruction/what-is-supplemental-instruction).

1.12. **Contacts.** Electronic communications will be made to the professor and teaching assistants through Piazza. A link is provided on Canvas to connect to Piazza.
1.12.1. Email Correspondence. For most purposes, do NOT email a teaching assistant of professor directly. These emails are likely to be ignored.

1.13. Letters of Recommendations. Letters of recommendations will generally not be written. Exceptions to this policy may be made by the professor on a case-by-case basis.

1.13.1. FERPA Requirements. Any letter of recommendation written must have a FERPA waiver on file with the professor writing the letter.
II. Office Hours

1.1. Office Hours. The teaching assistant(s) will hold regular office hours to assist students with the course material and with their lab assignments.

1.1.1. Information. Information including times and locations will be posted to Canvas.

1.1.2. Rules for Help. The teaching assistants have been instructed NOT to give answers but try to lead you to answers or show you where the information can be found. The teaching assistants may point you to a place to read information rather than tell you the information outright.
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III. Course Work

1.1. Textbooks. The textbook is an inclusive access “Zybook”, which may be accessed through Canvas.

1.2. Assignments. Students will be assigned and graded based on a variety of assignments.

1.2.1. Submissions. All assignments will be submitted to Canvas. Submissions sent via Piazza or email to a professor or teaching assistant will be ignored.

1.2.2. Homework. Students will complete homework assigned using the Zybook, which will submit to Canvas.

1.2.3. Labs. Weekly labs will be assigned on Canvas. All submissions must be made through Canvas (see Figure 1).

![Figure 1: Submitting Lab Assignments](image)

1.2.3.1. Lab Attendance. Students must attend their registered lab sections. Unless given specific permission, students will NOT attend a lab section for which they are not registered.

1.2.3.2. Lab Submission. Students must submit their labs using Canvas.

1.2.3.2.1. Diligence. Students must check their submission to ensure it is the correct submission and that it properly submitted. NO EXCEPTIONS will be made for incorrect submissions.

1.2.3.2.2. Recency. Only your latest submission will be graded. If you previously submitted your lab prior to the due date and subsequently submitted past the due date, the lab submitted past the due date will be graded and subject to late penalties.

1.2.3.2.3. Comments. Students may make comments on their submission; however, these have no bearing on the students’ grading. Graders are NOT given notification when a student makes a comment. Therefore, students will not make comments after the assignment has been graded.

1.2.3.3. Lab Solutions. Lab solutions will not be distributed. See your teaching assistant for questions about any of your lab submissions.
1.2.4. Class Participation. Class participation will be graded using TurningPoint "clickers". See: https://www.turningtechnologies.com/turningpoint.

1.2.4.1. Registration. Students must use the provided link on Canvas to register their clicker for the course. Unregistered clickers cannot be graded.

1.2.4.2. Clicker Access. Physical, mobile, and/or online clickers may be used in class.

1.2.4.2.1. Switching Response Devices. Students must not switch clicker devices during a class session. However, students may switch devices between sessions (e.g., between Tuesday's and Thursday's classes).

1.2.5. Exams. Students will complete exams on Canvas during their lab period, unless otherwise noted. The final exam will be given during the sanctioned final exam period and will be a written, paper exam in the classroom (Min Kao Room 622).

1.2.5.1. Missing Exams. Students must notify their professor in writing that they will miss an exam at least one (1) week prior to the exam. Approved missed exams must be taken as soon as possible. Note that make-up exams may or may not be taken in the same place as the original exam.

1.2.5.2. Disability Services. Students who need extra time for an exam must take the exam at the Student Disability Services Testing Center (SDS) (see: https://sds.utk.edu/testing-center). Disability services will be provided a hard-copy version of the exam and will email the completed exam to the professor.

1.2.5.3. Make-up Exams. Make-up exams will only be offered to those who are excused from the original time or place. To avoid potential cheating, make-up exams may or may not be the original exam.

1.2.5.3.1. Excused Exams. For some circumstances, such as a long break, an exam may be excused completely, and no make-up exam will be offered. These exams will neither count for nor count against your grade.

1.2.5.4. Viewability. Exams are considered work product and may or may not be returned to students. However, students always reserve the right to view their results.

1.3. Due Dates. All due dates will be listed on Canvas.

1.3.1. Diligence. Students are responsible to check Canvas regularly for any due dates.

1.4. Late Policy. Students may submit assignments up to two (2) days late.

1.4.1. Penalty. Late assignments will be penalized 15% per day it is submitted past the due date. The penalty is automatically applied by Canvas.

1.5. Grading.

1.5.1. Weights. The weight of each grading category is listed on Canvas under “Syllabus”.

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1.5.2. **Canvas.** Students must make sure that the checkbox shown in Figure 2 is *unchecked*. This checkbox can be found under the “Grades” section of Canvas. If this box is checked, assignments not submitted will not count against the student’s grade.

![Checkbox](image)

*Figure 2: Canvas Grading Checkbox*

1.5.3. **Homework.** Homework is automatically graded by Canvas through the Zybook.

1.5.4. **Labs.** Teaching assistant(s) will typically grade lab submissions.

1.5.4.1. **Comments and Formatting.** All student lab submissions must be properly formatted and commented, including a commented header which includes the student’s name, date, and a summary of the lab.

1.5.4.2. **Compiling Requirement.** Unless otherwise noted, all labs that do not compile on the EECS-IT lab machines (i.e., Tesla, Hydra, and Arc lab machines) using the given compiling commands will be graded 0.

1.5.4.2.1. **Appeals.** Students will not appeal a 0-grade due to compiling problems.

1.5.5. **Appeals.** Students may appeal the grade they received on any assignment.

1.5.5.1. **Appeal Procedure.** Students must use Piazza and put in writing their intention to appeal a grade. The Piazza message must be sent to all "Instructors".

1.5.5.2. **Timeliness.** Appeals must be made within **seven (7)** calendar days of receiving the grade.

1.5.5.3. **Regrading.** A TA may regrade a student’s work without regard to their previous grade. Therefore, the student may receive a lower grade after an appeal.

1.6. **Grade Curving.** Grades will not be curved or rounded. Grades will not be "bumped" to another grade level no matter how close it is.

1.7. **Extra Credit.** Several opportunities may be given to earn extra credit.

1.7.1. **End of Course Survey.** An end of course survey will be offered. This course survey will permit a student to earn extra points towards their final grade. This is used in lieu of curving and rounding grades.

1.7.1.1. **Survey Credit.** The amount of extra credit given for the end of course survey will be indicated on Canvas.

1.8. **Workload Recommendation.** COSC130 requires a significant amount of weekly work to succeed. As such, students should not take more than this course over the summer. All considerations should be discussed with a student’s advisor.
1.9. Official University Appeal. A student may appeal their final grade with the University of Tennessee. The procedures for doing so are outlined at:

IV. Code of Conduct

1.1. **Honor Statement.** Students will conduct themselves according to the University of Tennessee Hilltopics Honor Statement, which may be viewed at: http://catalog.utk.edu/content.php?catoid=24&navoid=3078#hono_stat.

1.2. **Behavior.** Any student who exhibits inappropriate behavior may be admonished immediately and/or referred to student conduct (see section 1.3.4.5 below). Continued inappropriate behavior may involve the University of Tennessee Police Department (UTPD).

1.3. **Plagiarism and Cheating.** Any student who is suspected of plagiarism and/or cheating will receive a penalty for doing so. The student will not be notified in advance at the penalty or that they were suspected of violating the plagiarism and/or cheating policy. Instead, it is the student’s responsibility for contacting their professor.

1.3.1. **Examples of Cheating.** Plagiarism and cheating may result from a student copying an assignment or sections of an assignment from another student, from an online source, or from the student’s own previous assignment (from a previous attempt at the course).

1.3.2. **Examples from Student Code of Conduct.** The student code of conduct lays out what a student may consider violating this plagiarism/cheating policy.

1.3.2.1. **SECTION 10.4.** Plagiarism is using the intellectual property or product of someone else without giving proper credit. The undocumented use of someone else’s words or ideas in any medium of communication (unless such information is recognized as common knowledge) is a serious offense, subject to disciplinary action that may include failure in a course and/or dismissal from the University. Specific examples of plagiarism include, but are not limited to:

   1.3.2.1.1. Using without proper documentation (quotation marks and citation) written or spoken words, phrases, or sentences from any source.

   1.3.2.1.2. Summarizing without proper documentation (usually a citation) ideas from another source (unless such information is recognized as common knowledge).

   1.3.2.1.3. Borrowing facts, statistics, graphs, pictorial representations, or phrases without acknowledging the source (unless such information is recognized as common knowledge).

   1.3.2.1.4. Collaborating on a graded assignment without the instructor’s approval.

   1.3.2.1.5. Submitting work, either in whole or partially created by a professional service or used without attribution (e.g., paper, speech, bibliography, or photograph).

1.3.2.2. **SECTION 10.5.** Specific examples of other types of academic dishonesty include, but are not limited to:

   1.3.2.2.1. Providing or receiving unauthorized information during an examination or academic assignment, or the possession and/or use of unauthorized materials during an examination or academic assignment.
1.3.2.2. Providing or receiving unauthorized assistance in connection with laboratory work, field work, scholarship, or another academic assignment.

1.3.2.3. Falsifying, fabricating, or misrepresenting data, laboratory results, research results, citations, or other information in connection with an academic assignment.

1.3.2.4. Serving as, or enlisting the assistance of, a substitute for a student in the taking of an examination or the performance of an academic assignment.

1.3.2.5. Altering grades, answers, or marks in an effort to change the earned grade or credit.

1.3.2.6. Submitting without authorization the same assignment for credit in more than one course.

1.3.2.7. Forging the signature of another or allowing forgery by another on any class or University-related document such as a class roll or drop/add sheet.

1.3.2.8. Gaining an objectively unfair academic advantage by failing to observe the expressed procedures or instructions relating to an exam or academic assignment.

1.3.2.9. Engaging in an activity that unfairly places another student at a disadvantage, such as taking, hiding, or altering resource material, or manipulating a grading system.

1.3.3. Working Together. Students are encouraged to work together, however this increases the risk of plagiarism and/or cheating. Students are cautioned to make sure that when they work together that their code cannot be seen by another student. We recommend that students work together by placing their laptops back to back. With this method, students may discuss topics, but the code they write is purely their own.

1.3.3.1. Citation. Always cite any professor, teaching assistant, or another student with whom you discussed the work with. Even if you cannot see another student’s code, the chances of parallel thinking are increased. When you cite whom you worked with, we can understand where your lab may look like another.

1.3.3.1.1. Parallel Thinking. Citations do NOT preclude you from abiding by the plagiarism/cheating policy. Even if you cite your source, you may still not copy code in portions or entirety.

1.3.4. Penalties. The professors and teaching assistants are not investigation units. Therefore, anyone found in violation of the plagiarism policy will receive the same penalty regardless of who originated the content.

1.3.4.1. Labs/Homework. Students will receive a 0 for the lab or homework and a ten (10) point drop on their final grade. This will appear as a “Plagiarism” column on Canvas. Essentially, it removes exam points to achieve a 10-point drop on the student’s final grade.
1.3.4.1. **Repeated Violations.** Repeated violations of the plagiarism or cheating policy will result in a 0 for the course.

1.3.4.2. **Exams.** Any suspected plagiarism and/or cheating on an exam will result in a 0 for the course.

1.3.4.3. **Stolen Work.** If an allegation of theft is made, the theft will immediately be reported to student conduct for an investigation.

1.3.4.4. **Extended Scrutiny.** After a student has been flagged for potential plagiarism, all other works will be more closely scrutinized for plagiarism, past and present. Students will note that if they have not been caught for plagiarism, it doesn’t mean it’s not plagiarism. Therefore, if a previous work was plagiarized, the student or students responsible will be held to account for multiple violations of the plagiarism policy.

1.3.4.5. **Referrals.** The professors and teaching assistants reserve the right to refer any student behavior to student conduct regardless of previous incidents, or lack thereof. More information about referrals and student conduct may be found at: [https://studentconduct.utk.edu](https://studentconduct.utk.edu).
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V. Transcript Grades

1.1. Letter Grades. Numeric grades will follow Table 1 to translate to the final letter grade.

1.2. No Credit. Students who earn below a C will receive a grade of NC (No Credit). Information about the NC grading may be found in the University of Tennessee Catalog: http://catalog.utk.edu/content.php?catoid=24&navoid=3078#ABC_NC_grading

<table>
<thead>
<tr>
<th>Letter</th>
<th>Floor (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>93</td>
</tr>
<tr>
<td>A-</td>
<td>90</td>
</tr>
<tr>
<td>B+</td>
<td>87</td>
</tr>
<tr>
<td>B</td>
<td>83</td>
</tr>
<tr>
<td>B-</td>
<td>80</td>
</tr>
<tr>
<td>C+</td>
<td>77</td>
</tr>
<tr>
<td>C</td>
<td>73</td>
</tr>
<tr>
<td>NC</td>
<td>0</td>
</tr>
</tbody>
</table>

*Table 1: Letter Grade Conversion*
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VI. Schedule

1.1. Dates. All key dates will be listed on the course calendar on Canvas.

1.2. Attendance. Attending all lectures and labs is mandatory.

1.3. Lecture. Lectures will be held on Mondays, Tuesdays, Wednesdays, Thursdays, Fridays in Min Kao Room 525. Lecture begins at 1540 and ends at 1655. Students are expected to attend all lectures.

1.3.1. Exam Days. Fridays will typically be used as an exam day. Students must not miss an exam without prior approval.

1.3.2. Instructor. A teaching assistant or another professor may substitute for a class, or a class may be canceled if the primary instructor is unable to teach for any reason, such as due to an illness.

1.4. Labs. All lab periods are on Mondays and Wednesdays in Min Kao Room 421 (Hydra Lab) and are 1 hour and 30 minutes in duration. Refer to Table 2 for your lab section starting and ending times.

<table>
<thead>
<tr>
<th>Section</th>
<th>Starts</th>
<th>Ends</th>
</tr>
</thead>
<tbody>
<tr>
<td>501</td>
<td>1330</td>
<td>1500</td>
</tr>
</tbody>
</table>

*Table 2: Lab Sections*
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VII. Weekly Topics

1.1. **Summer 2019.** The weekly course schedule, Table 3, describes the topics that will be covered during the semester.

1.1.1. **Date.** The date refers to the first day of the week that the topics will be covered.

1.2. **Changes.** Changes to the schedule may be made with or without notice.

<table>
<thead>
<tr>
<th>Week</th>
<th>Begins</th>
<th>Topics</th>
</tr>
</thead>
</table>
| 01   | 07/08  | Introduction  
Number systems  
Bitwise operators  
Binary arithmetic  
Two’s complement |
| 02   | 07/15  | Floating point  
Dynamic memory  
Pointers  
C-style binary files |
| 03   | 07/22  | RISC-V assembly  
Address modes  
Branching / ABI  
Structures (N.O.S.)  
Encoding / decoding instructions |
| 04   | 07/29  | Truth tables  
Product of sums  
Sum of products  
Sequential circuits  
Finite state machines  
Boolean algebra  
Karnaugh maps |
| 05   | 08/05  | Computer organization  
Arithmetic & logic unit  
Cache  
Pipelining  
Memory management unit (SV32) |

*Table 3: Weekly Topics*
VIII. Learning Objectives
At the conclusion of this course, successful students should be able to accomplish or understand the following:

**Number Systems and Bases**
1. Understand how hexadecimal, binary, and decimal interoperate.
2. Convert between different number bases.
3. Understand why hexadecimal and binary are widely used in computing.

**Binary Arithmetic**
1. Understand how an arithmetic logic unit works.
2. Perform basic arithmetic with numbers of varying bases.
3. Understand how a computer performs the same basic arithmetic.

**Computer Architecture / Assembly**
1. Understand how memory is allocated/deallocated on the stack, heap, and data sections.
2. Understand how executable programs are formatted.
3. Be able to create a basic assembly program.
4. Understand how high-level languages abstract different programming aspects.
5. Appreciate high-level languages, such as C++.
6. Understand how parameters and return data is used in assembly.
7. Understand hierarchies of memory, such as registers, RAM, and mass storage.

**Computer Organization**
1. Understand the benefits of pipelining.
2. Understand why pipelining improves CPU performance.
3. Understand the hazards associated with pipelining.
4. Understand how cache improves memory performance.
5. Understand the different cache techniques, including direct-mapped, set-associative, and fully associative techniques.
6. Understand how cache units are evicted and what techniques are used to determine eviction.

**Digital Logic**
1. Understand rudimentary logic gates, such as AND, OR, XOR, and NOT.
2. Be able to design a digital logic circuit to accomplish a basic task, such as addition.
3. Understand combinational and sequential logic.
4. Be able to reduce circuits using Boolean algebra and Karnaugh maps.
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IX. Summary of Changes
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X. Approval

X
Dr. Stephen Marz
Lecturer