Course Number:	**MECH 4250**	Semester**: Fall 2017**

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Course Title: **Comprehensive Design II**
Credit Hours: 2 (LEC 1, LAB 3)
Prerequisites: MECH4240, and any two of MECH3040, 3050, 3140
Co-Requisites: INSY3600, and the remaining two of MECH3040, 3050, 3140

Class Schedule
Lec/Lab:
Monday: 10:00-10:50 am, Davis 155
Tuesday & Thursday: 8:00-9:15 am, Lowder 10

Instructor
David Beale, Ph.D., PE, Mechanical Engineering Dept., 3418C Wiggins, 844-3336, dbeale@eng.auburn.edu
Office Hours: MWF 9:00 – 10:00 and by appointment.
TA1: Amanda Skalitzky, ams0110@tigermail.auburn.edu , hours TBD by appointment (Project Room, ordering, technical assistance, peer reviews); TA2: Michael Halverson, mch0025@tigermail.auburn.edu, available during classtime and by appointment (ordering, technical assistance, attendance); TA3: Kyle Kubik, kak0032@tigermail.auburn.edu, by appointment (assists as needed)

Website
General information and course material can be found at: http://www.eng.auburn.edu/users/bealedg/MECH4240-50/
Textbooks: None
Final Presentation: Demonstration of working prototype to industrial sponsor
Grading and Evaluation Procedures: See below for detailed evaluation procedure. 90-100 A, 80-90 B, 70-80 C, 60-70 D, <60 F
Accessibility
The policy of Auburn University is to provide accessibility to its programs and activities, and reasonable accommodation for persons defined as having a disability under Section 504 of the Rehabilitation Act of 1973, as amended, and the Americans with Disabilities Act of 1990. Students needing special accommodations should see the instructor as soon as possible, or contact the Students with Disabilities Program (334) 844-5943 (Voice/TT).
Academic Honesty
All portions of the **Auburn University Student Academic Honesty Code**, as found in the *Tiger Cub* and defined in the SGA Code of Laws, Title XII, will apply in this class.
  http://web6.duc.auburn.edu/tigercub/rules/section1.pdf   http://www.auburn.edu/tigercub/rules/code_of_laws.doc

Grading for Each Student, Except Manager. (The manager will be graded by Dr. Beale and/or technical advisor assessment of the satisfaction of the MPCOD (described next page) at the Prototype/Product Demonstration).

Grade Component	Percentage
Final Team Grade (**FT**)*	50%
Peer Review Score (**PR**)	30%
Attendance **	10%
MPCODGrade (Manager's Project Contract of Deliverables)*******	10%

* **FT:** See formula below**.** All students on a team receive the team's FT grade unless COD(s) + Deliverable(s) are not acceptable to the manager, or manager and technical advisor. A student's **Total Score** may be reduced by 3% per COD (Contract of Deliverable) for every deliverable that is not turned in to the manager on time or does not satisfy the COD. There will be five CODs + deliverables throughout the semester for each team member and are written on the schedule when these are due.   The manager works with the student and/or student team to define the CODs. The manager should keep a binder with a copy of each COD.

** **Attendance:** Attendance will be taken, but it is not necessary to report to the classroom. The whereabouts of each student should be conveyed to the TA by the manager before or during class so attendance can be taken. Three points will be taken off for each unexcused absence from the student's **Total Score**.

*** **MPCODGrade:** All teams will need to complete their MPCOD by the date listed on the schedule below. This is a checklist of tasks and stated measures of successful completion of each task. The sponsor must agree with the MPCOD, as a fulfillment of their expected project deliverables; in many situations the manager may need to negotiate with the sponsor. The first draft of this will be reviewed by the technical advisor (and perhaps the professor). After editing and negotiating, it will signed by the technical advisor and sponsor. It will be reviewed again halfway through the semester, to assess progress toward completion. A portion of the MPCODGrade will include an assessment by TAs and Technicians in the shop of how the student team handled Cleanliness in the project room, Cooperation in the project room, and an assessment of Configuration Management file system.

Formula for Student's Final Grade (**Total Score**)

Total Score = .5xFT + .3xPR + .1xAttendance + .1xMPCODGrade

where:

FT = (.5xFS + .4xFR + .1xFN)

FT = <u>F</u>inal <u>T</u>eam Grade; FS = <u>F</u>inal <u>S</u>ponsor Grade; FR = <u>F</u>inal <u>R</u>eport Grade; FN = <u>F</u>inal Design <u>N</u>otebook Grade;

PR = SNPR/8.0 x FT/100: SPNR = Student's Normalized Peer Review (SNPR) score as assigned by the manager, and normalized to 8.0 as average for your team. The normalized score is the value seen by the student on Canvas. Others could also be peer reviewing, e.g. the technical advisor may be asked to perform a peer review in addition to the manager.

Attendance = 100 – 30x(number of unexcused absence).

MPCODGrade = *MPCOD Deliverables Assessment + Cleanliness/Cooperation/Configuration Management*

MECH4250 Details

The objective of the semester is the completion of a design project, culminating with a Prototype/Product Demonstration to the sponsor and delivery of the final report and design notebook.

The process is a continuation of systems engineering process, moving up the "right leg" of the Vee Chart. We start the semester by formulating the MPCOD (Manager's Project Contract of Deliverables).

The MPCOD

The MPCOD is a 1 page document that states the project deliverable(s) that will be demonstrated at the end-of-semester prototype/product demonstration; think of the MPCOD as defining your target for course completion.   It should be carefully crafted by the Manager, team and Technical Advisor during the first or second week, and later approved by the corporate sponsor.   It will bind your team to produce a product or prototype (or portion thereof), that meets first semester requirements (on performance, quality, verification tests, etc.) toward the mission objective.

The MPCOD protects the team from "mission creep". A guiding principle to its formulation is that it requires tasks that can be accomplished by the student team within the semester timeframe. Promise only what you can deliver; negotiate with the sponsor if necessary.   It will serve as the basis for end-of-semester grading of the student team by the sponsor, and grading of the manager by the Dr. Beale and technical advisor.

Manager's Duties and Grading of Manager (of course, a good manager knows how to assign tasks…)

The manager is the project leader and systems engineer. The manager's objective is the completion of the deliverables defined in the MPCOD. Manager's duties include:

1) Creating and carefully crafting of the MPCOD with the student team. These are project deliverables listed on a single page. Caution: Promise in the MPCOD only what you can deliver, assemble and test.

2) The MPCOD requires approval of the corporate sponsor.

3) It is the manager's responsibility to schedule tasks and make sure they are completed in order to deliver a working prototype/product. The manager's course grade will be given by the Dr. Beale in consultation with technical advisor(s), and based on how well the MPCOD deliverables are met.

4) Approve and guide student COD preparation.   CODs here could be for manufacturing of a part by the student or drawings for an outside machine shop, planning for and testing of a subsystem or component, updating drawings, purchasing materials, etc.

5) Make sure that the final report is completed and delivered by the end of the semester. The final report will be a continuation of the systems engineering process and incorporates much of the final report from last semester. If the last semester final report covered through Phase C (detailed design), you will add the "right side of the Vee-chart" details to the report, in particular completed and updated orthographic projections, verification and documentation of testing of each subsystem, verification and documentation of the integrated subsystems, and validation testing (i.e. operating the system in a fashion like the ConOps require). Include safe operating instructions, update drawings and requirements as necessary, and update the corporate drive to include these files.

7) Prepare for and present (with the team) a prototype/product demonstration to the corporate sponsor at the end of the semester, or sooner. There are no PowerPoint presentations this semester. There is no midterm report/presentation.

8) The manager's grade will be determined by Dr. Beale in consultation with the technical advisor(s) based on the prototype presentation result and if MPCOD deliverables have been achieved, and delivery of all other course requirements.

9) Email to Dr. Beale and TA before each class where students will be working. Here is an example email:

> "Tuesday Class: Group meets in AE156 for 10 minutes. After that, CAD team will be in SB2 computer lab, Machine Design team should be in DML, and lastly John Smith will be going to Home Depot."

10) Each student must make copies of each signed COD for themselves and the manager. The CODs will be kept in a binder by the manager, for inspection throughout the semester. In the binder keep a chart of COD assignments that lists for each student their name, COD title, date assigned and date due.

11) The manager acts as Systems Engineer, or assigns this task to another student.   A significant aspect of SE is to assign students to 1) perform and document verification testing of subsystems and assembly, 2) to update drawings and interfaces, and 3) to always be aware of and vigilant for potential sources of risk and managing that risk.

12) The manager peer reviews each student on the team (3-4 times per semester).

System Validation Check To Technical Advisor (on or before Week 15)

Just before the final presentation/demonstration, the student team should show their operating system to their technical advisor. The advisor can assess system integration (and how well components and subsystems mate and interface within the prototype), and assess performance during System Validation testing in accordance with or similar to the ConOps. If parts don't fit together, bolts holes don't match, unwanted interferences occur, your part is undersized, etc., these faults will be evident during the System Validation demonstration. CODs and deliverable will pinpoint the particular student(s) responsible for a substandard or failed assembly. Similar can be said for electrical and electromechanical and software systems - faults in these systems will also be evident.

For parts not made on the benchtop mills and lathes in the project room, carefully plan how you will have those parts manufactured, either by 1) parts you will make in the DML or Senior Project Room, 2) parts you request to be made by Dr. Payton and his TAs, e.g. complicated parts, CNC parts, 3) parts to be made by outside contract shops or sponsor.

Important Points

1. Once a team has completed its MPCOD deliverables and System Integration/System Validation check, the team is ready to demonstrate their prototype/product to the sponsor.

2. Manager has prerogative to assign tasks with CODs as necessary to complete MPCOD.

3. At the end of the semester the Dr. Beale in consult with the technical advisor will grade the manager based on accomplishment of the MPCOD's stated deliverables.

4. This class emphasizes skills you will need when you become practicing engineers, such as working under contracts, timeliness, teamwork, responsibility, quality of output, accountability and planning.

5. If you hit an obstacle trying to accomplish your deliverables on time, see your technical advisor or Dr. Beale as soon as you can and we will remedy the situation.

6. There are many kinds of deliverables for a COD. For example: Making a Gantt Chart, making a CAD drawing, investigating and choosing the best bolts and fastening hardware, assembling several parts; contracting and monitoring manufacture of a part by an outside contractor, writing a software code, interfacing sensors to a computer, making a part in the DML, etc.

7. Maintain your design notebook to record your test data/results, and any other useful information. It will be graded.

8. Make sure your team can deliver what you promise in the MPCOD. An overarching objective here is quality of product and process rather than quantity.

Unaccelerated Calendar*

	All Students Attend	Managers Only Attend	Team Presentation – Date TBD
WEEK 1	21 August:	22 August: First Day, Syllabus Overview	24 August: Shop Overview (Kyle Class)
WEEK 2	28 August: Dr. Payton Recertification	29 August:	31 August: MPCOD Draft Due
WEEK 3	4 September: NO CLASS	5 September: Manager Only Meeting, MPCOD's Returned	7 September:
WEEK 4	11 September: Signed MPCOD Due	12 September:	14 September: Peer Review 1 Due
WEEK 5	18 September: **COD 1 Due**	19 September:	21 September:
WEEK 6	25 September:	26 September:	28 September:
WEEK 7	2 October:	3 October:	5 October: Peer Review 2 Due
WEEK 8	9 October: **COD 2 Due**	10 October:	12 October: NO CLASS
WEEK 9	16 October: Review MPCOD with Managers	17 October:	19 October:
WEEK 10	23 October: Updated MPCOD Due (If Needed)	24 October:	26 October:
WEEK 11	30 October: **COD 3 Due**	31 October:	2 November: Peer Review 3 Due
WEEK 12	6 November:	7 November:	9 November:
WEEK 13	13 November:	14 November:	16 November: **COD 4 Due**
WEEK 14	20 November: NO CLASS	21 November: NO CLASS	23 November: NO CLASS
WEEK 15	27 November: System Validation to Tech Adv	28 November: System Validation to Tech Adv	30 November: System Validation to Tech Adv
WEEK 16	4 December: ORR (Peer Review 4 Due and **COD 5**)	5 December: ORR (Peer Review 4 Due and **COD 5**)	7 December: ORR (Peer Review 4 Due and **COD 5**)
WEEK 17:	11 December: FINAL EXAMS (ORR Presentation if needed)	12 December: FINAL EXAMS (ORR Presentation if needed)	14 December: FINAL EXAMS (ORR Presentation if needed)

* These tabled dates can be accelerated, hence some scheduled event dates can be treated as schedulable "on or before" the tabled date, if a manager receives approval from the instructor.