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| **1. Course title/number, number of credit hours**  |
| **EOC 4804 Ocean Engineering Systems Control & Design** |  3 credit hours |
| **2. Course prerequisites, corequisites, and where the course fits in the program of study** |
| Prerequisites: All 3000 level core engineering courses required by the Department, excluding EOC3114 and EOC3213, and including EOC 4193 and EGN 4432 (each with a minimum C grade) |
| **3. Course logistics** |
| *Term*: Fall 2013*Class location and time*: EG162, Tues/Thurs 10-11:20 |
| **4. Instructor contact information** |
| *Instructor’s name**Office address**Office Hours* *Contact telephone number**Email address* | Karl von EllenriederEG182TR11:30 AM-12:30 PM(561) 297-7232ellenrie@fau.edu |
| **5. TA contact information** |
| *TA’s name**Office address**Office Hours* *Contact telephone number**Email address* | **N/A** |
| **6. Course description** |
| Mission:To introduce students to theoretical and applied engineering design through lectures and challenging applied ocean related design projects and to cultivate all engineering skills necessary to succeed in the multidisciplinary field of Ocean Engineering.Class Overview:Subject material in this course will include the design process, as well as design projects of varying scales. In addition, the course will include material on selected subjects chosen to help round out and bring together each student’s knowledge. The course will place emphasis on initiative to develop definitions and formulate solution approaches. ***The course will rely on self-learning in the manner which is expected in the work force.*** A large and long-term project (fall through spring) will be assigned to facilitate practical implementation of engineering design and the design process. This course is intended to complete the student’s engineering education. Thus, upon completion of this course, the student must demonstrate:* an ability to apply knowledge of mathematics, science and engineering;
* an ability to design systems, components and processes to meet desired needs;
* an ability to function in multi-disciplinary teams;
* an ability to identify, formulate and solve engineering problems;
* an understanding of professional and ethical responsibility;
* an ability to communicate effectively
* an ability to use the techniques, skills and modern engineering tools necessary for engineering practice;
* the ability to understand the impact of engineering solutions in a global and societal context; and
* a knowledge of contemporary issues.

The class follows two parallel and simultaneous paths. One path introduces students to design theory and supporting skills, such as the design process, systems engineering, project management, ethics, and report writing. In parallel, students work in a hands-on sense to complete a design project over the two semester course. Project Structure:Today’s high tech engineering firms are unlike the highly mechanistic bureaucracy designed to work in the stable simple environments of years past. Instead, they are organic with a low degree of formality and standardization; decentralized in decision-making; and have well-integrated activities. This loose structure provides the necessary flexibility to rapidly respond, restructure, and attack engineering problems in today’s fast-paced global environment. This design project component of the course is formatted to reflect this structure and to provide students with experience operating in such a structure.The premise is that the class consists of people with the necessary ocean engineering skills that can be formed into such organic companies to rapidly design advanced ocean systems. To this end, the design class will form such organic companies that are awarded a contract to design, build, and demonstrate an ocean system. To begin each task, each company will submit a project definition and conceptual design plan. This will be the basis of the project and provide confidence to the funding agency (your instructors) that you have thought through and mapped out the system development. The period of performance is seven months, after which time, the company must have completely engineered their design, constructed the components, integrated them into the overall system, tested and demonstrated their technology.All successful small engineering companies are well organized with a clear breakdown of responsibilities because completion of a project is much more than the detailed engineering. To accomplish this, each company shall divide into smaller component-specific design teams that shall work together in a cooperative, synergistic atmosphere to complete the chosen project by building a demonstration prototype. Operation of a small engineering company is also multifaceted and must address such items as project management, planning, personnel, finance, administration, and quality control. In addition, although the company’s structure is organic, it will function within the highly structured environment of the university. As such, there are many processes and procedures that must be followed and significant amounts of paperwork that need to be completed to accomplish most tasks. One person cannot learn all of these tasks or even a significant portion. Thus, a low-level company structure is adopted to provide the necessary organization and functional breakdown necessary to efficiently operate and succeed. As such, several members of the class will be assigned duties in addition to regular engineering design duties A student assigned to a particular position will hold that position for the duration of the project, unless at least 75% of the group feels their efforts would be better served with another individual in that position. This methodology provides for a clear breakdown of responsibilities that allows for efficient operation because each student manager only needs to develop a functional knowledge of their areas to become proficient without task duplication. It also eliminates the need for all students to become familiar with the overall bureaucracy of the University. To assist each student manager, a faculty or staff member that specializes in the task area will be assigned to assist the student and provide necessary guidance. The Department is committed to helping each design group succeed. To this end, the Department is making available technical staff to help you with your designs, please use them Management Positions:1) Project Manager:Responsibilities:The project manager, who, in addition to their design tasks, shall be in charge of coordinating component-team efforts to ensure that: the overall design goals will be achieved, each component design team is on track and on time; and each component will integrate into the overall project. To facilitate this, MS Project will be used and is available on the computers in the design lab• Develop and keep updated an detailed MS Project Gantt Chart• Develop a list of milestones and associated dates• Track progress on the project and identify problems.As well, group members often have different work schedules and live in different locations. To overcome the resulting communication and coordination difficulties, the project manager shall oversee the development of a group sharepoint site (such as Google Docs). This site shall be used to post meeting times, project time lines, share files, questions, etc. Finally, the project manager will, in conjunction with the design teams, prepare a weekly update report.• Problem solving between groups and mangers• Organizing management and class meetings• Overall project oversight• Sharepoint management2) Personnel Manager:Responsibilities:• Mitigate personnel problems• Arrange personnel training certifications (machine shop, forklift, boating, safety, etc) and keep a record of the certifications3) Administration Manager:Responsibilities:• Assembly of overall reports, including weekly reports, PDR, and CDR• Track and file all non-financial paperwork and requests• Organizing, submitting, tracking, and recording of boat requests, vehicle requests, environmental health and safety issues, etc.• Accident reporting4) Financial and Purchasing ManagerResponsibilities:• Develop and keep up to date a project cost ledger• Assemble, submit, and track purchase orders• Submit paperwork for P-Card purchases• Track all purchases, keeping records up to date, including timely filing of P-Card worksheets.5) Quality Control Manager:Responsibilities:• Quality review of all drawings and documents, ensuring they meet the standards set forth in the class• Assign reviews of engineering calculations - all engineering calculations must be reviewed by an independent person. • Review machining, construction, and testing of prototype to ensure it meets tolerances and requirements.Milestones:The major milestones of the projects are:Date Topic18-Sep Project Definition Conceptual Design Document16-Oct Preliminary Design Report15-Nov Critical Design Report27-Nov Critical Design Review Presentations29-Nov 7:45 - 10:15 PM CDR Feedback & Spring PlanningAt the end of each term, a single overall report will be required from each company that details each team’s work and integrates the various components into the complete design. The project leader will be responsible for ensuring its completeness and organization. Additionally, each student will be required to maintain an engineering log book of their efforts on the project, keeping track of the time they spent, the tasks being worked on, etc. In parallel, each student will be required to maintain a portfolio of his or her efforts that is synchronous with the logbook. Both the logbook and portfolio shall be submitted to the instructor at the end of the term. In the final semester the functionality of the prototypes will be tested and the resulting performance will be compared to the design requirements. Each company will be required to operate their designs at sea through a mission that will test the design requirements.The course shall complete with each company presenting their design in a public forum that will finish with the operational demonstration of their prototype (note, functional, at-sea testing of prototype designs is the main goal of the second semester, public demonstrations are essential, but of lesser importance). |
| **7. Course objectives/student learning outcomes/program outcomes** |
| *Course objectives* | To introduce students to engineering design and the design process through applied ocean related design projects. Emphasis shall be placed on professionalism, creativity, engineering, design logic and communication. |
| *Student learning outcomes**& relationship to ABET a-k objectives* | Principally ABET Outcome C: an ability to design a system, component, or process to meet desired needs. |
| **8. Course evaluation method** |
| Project Grading:Keeping with the premise of the course, each company will be awarded a performance based contract to complete their system. This contract will pay each team for their work with marks. Assuming that all deadlines are met and requirements are achieved, the full 50 marks will be awarded. The payment schedule is as follows:Fall TermProject Definition and Conceptual Design 5 ptsPreliminary Design Report 10 ptsCritical Design Report 30 ptsCritical Design Presentation 5 pts However, this is a performance based contract that also includes bonuses and penalties. There are two sets of bonuses and penalties: Time Based Completing tasks ahead of schedule +1 mark per 2 days early, up to 20% of valueCompleting tasks behind schedule -1 mark per day late for the first 4 days, then -3 marks per day thereafter, up to 100% of valueQuality BasedTask Exceeds Requirements Up to 20% bonusTask Fails to Meet Requirements Up to 100% penaltyIf at the end of either term, your score exceeds 50 pts for the project, those points will be kept so your project mark may exceed 100%, thus, boosting your overall grade.WARNING: This project is very time intensive and cannot be completed in a last minute all-nighter! You need to start early and accomplish a significant amount of work before mid-terms, final exams, and other class assignments become due.Log Books and PortfoliosA. LogbooksLogbooks are organizational and tracking tools that are commonly used to create traceable and legal chronological written records of ones activities. Engineering Logbooks are very useful tools that not only help one remember ones activities, but they are also function to trace hours and personnel costs on different projects, as legal documents in inventions/intellectual property disputes and to prove proper engineering practice, as documentation for ISO certifications, as safety history, etc. For this course, each student is required to maintain individual hand written logbook as well as an MS Excel track of their work. The hand written logbook must conform to the following structure:1) All entries must be written in pen and entered chronologically2) Entries must outline all professional and related activities such as: • engineering tasks (design, calculations, testing, computer programming, etc)• research tasks (literature reviews, patent searches, etc.)• meetings (group, with clients, etc.)• machining, construction, and assembly tasks• testing and evaluation tasks.3) have a left-hand margin for the date, have a right-hand margin for your supervisor's signature, and a large middle section for the record of your work The MS Excel spread sheet will be used to track your time working on this project. Time logs are essential in all industries where people work on multiple projects over a contiguous timeline. Time logs provide a record that allows a persons time to be charged appropriately to the projects that they work on. The MS Excel spread sheet must have the following columns: 1) date2) task description3) hours worked this period4) project title5) cumulative hours worked on projectB. Portfolios Portfolios are a complete and organized collection of ALL of a student’s individual project specific work. Unlike the logbook which is in chronological order, the portfolio is logically organized into topic specific sections, such as design ideas, sketches, system layout diagrams, trade studies, engineering calculations; software layout - design and coding; instrumentation, documentation (only sections that the student wrote); plans and time lines; etc. Hand written work is acceptable and expected. As with the log book, this is also an essential document that records all the details of an individual’s work. It is useful as a reference to previous work as well as a starting point for others who wish to carry on with the work. It also is a legal document that details work on a topic and demonstrate that accepted and sufficient engineering was performed in the event of a failure. Thus, the portfolio must be a stand alone document that contains sufficient information and documentation so that a person who is unfamiliar with the project can understand and work their way through all entries - summary entries are not acceptable in a portfolio. For example, engineering calculations must show the complete development, referencing any formulas used, defining all terms, listing all assumptions, etc. Keep in mind that sections containing such items as engineering drawings that the student created, sections of reports written by the student, manufacturer’s specifications sheets sourced by the student, and etc. need only be organized in an orderly way, such as separated by tabbed pages with a leading index. For work such as construction that may not produce a written record, students need to ensure that their portfolio is reflective of their work. Thus, a photo record of construction and a thorough (very detailed) log is advised and such notes need to show up in the portfolio. The portfolio should be kept in one or more three ring binders. Note: Often in the design cycle, the design progress down a different path than initially envisioned, thus work, such as engineering calculations, drawings etc. become obsolete. It is recommended that these obsolete sections still be kept in the student’s portfolio for future reference (for example, to answer such questions as – why was this idea thrown out?) as well as, to keep an accurate record of the students work for marking.C. Logbook and Portfolio GradingThe portfolio and log book must be kept up to date and submitted at the end of the semester (I am happy to review portfolios during the term). Both will be used as the sole basis to determine each student’s individual effort that makes up 15% of their mark. Since the course instructors are not mind readers and cannot know/track/remember each student’s work, it is recommended that journals and logbooks be continuously updated and contain ALL the work of that student. Otherwise, the student’s actual effort will not be reflected, and the student will not receive a mark that mirrors the student’s efforts. Not only is keeping an up to date logbook and portfolio good practice, but if the student waits until the last minute to complete their portfolios and logbooks, they will likely forget to include items and/or run out of time assembling the portfolio. Marks for the logbook and portfolio will be assigned based on the instructor’s assessment as follows:LogbookAdherence to guidelines and format: 2 ptsCompletes 1 ptsPortfolioOrganization and neatness: 2 ptsContributions to project (combined from the logbook and portfolioQuality of Engineering Work 4 ptsQuality of other contributions 3 ptsQuantity of Work 3 ptsTotal marks 15 ptsPeer Evaluation:As part of a group, each team member is committed to a common purpose and must hold themselves mutually accountable in their efforts to achieve their goals. As such, each project group shall assess the performance of their team members through a peer evaluation form. Not only does this hold all team members accountable for their individual performance, but it also provides essential feedback of other group member’s perception of their performance and constructive feedback on how to improve their performance. Each semester, three equally weighted inter-team peer evaluations shall be given, the first on Oct 5, the second on Nov 2, and the last at the end of the semester. Within each group, individual team members will evaluate all of the other team members (within the whole project group) and rate their performance in several areas and behaviors. The ratings are:8 - Excellent=Consistently went above and beyond assigned tasks, carried more than her/his part of the load. 7 - Very Good=Consistently did what she/he was supposed to do.6 - Satisfactory=Usually did what she/he was supposed to do.5 - Ordinary=Often did what she/he was supposed to do.4 - Marginal=Sometimes failed to show up or complete assigned tasks.3 - Deficient=Often failed to show up or complete assigned tasks.2- Unsatisfactory=Consistently failed to show up or complete assigned tasks.1 - Superficial=Practically no participation.0 - No Show=No Participation at all.Each student will be evaluated on their• attendance at and constructive participation in group discussions• contribution to a fair share of the workload• quality of work done• completing work on time• contribution in developing, maintaining, integrating and communicating project deliverables• willingness to volunteer/accept tasks that need to be accomplished• ability to arrange personal schedule to fulfill commitments to the teamA total of 25 pts, 8.33 pts for each evaluation, is assigned for the peer evaluations. Ratings for each team member will be averaged from all team member rating sheets and the points (grade) will be assigned as follows: As can be seen, to earn all points, an average rating of 7 is needed. If the average is above seven, then the extra points will be considered as bonus. Also, each peer evaluation form provides space for constructive feedback. The information provided in the evaluations will be kept in strict confidence.Professionalism EvaluationProfessionalism is defined the expertness characteristic of a professional person. Professionalism is a set of accepted behaviors and attitudes that is expected of all practicing engineers. As such, each student is expected to be professional in all senior design actives and each student will be graded on their professionalism as perceived by the class instructor. Included in the evaluation of professionalism are teamwork, communication, punctual attendance to class and reliable contribution to projects, attitude, timeliness, completeness, integrity, and ethics. 10 points are assigned to professionalism, 5 points will be assigned at a mid term evaluation and 5 points will be assigned at the end of the semester. All students start out will full marks and marks are subtracted for unprofessional behavior and attitudes. Weekly ReportsEvery Wednesday, each project group and the Project Planning Team shall submit individual one page progress reports to the course instructor. These reports will be discussed in the Thursday class group meeting. These weekly progress reports should continue until the end of the semester. The purpose of the weekly reports is to keep track of the progress and to facilitate better communication among the team members, teams, and the instructors. The weekly reports need to address each of the following areas:1. Summarize the week’s accomplishments, with a few sentences or bullets. This should include: o Summary of work performed and list of tasks accomplishedo Discussion of any unresolved problems 2. Plan of work for the next week o Summarize your progress towards the next milestone in your schedule. This should include reasons for any discrepancies between actual progress and plano List of tasks to be completed in the upcoming week3. List of Issues, problems or questions that need to be discussed with the instructor |
| **9. Course grading scale** |
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| **10. Policy on makeup tests, late work, and incompletes** |
| *Makeup tests* are given only if there is solid evidence of a medical or otherwise serious emergency that prevented the student of participating in the exam. Makeup exam should be administered and proctored by department personnel unless there are other pre-approved arrangements*Late work* is not acceptable.*Incomplete grades* are against the policy of the department. Unless there is solid evidence of medical or otherwise serious emergency situation incomplete grades will not be given. |
| **11. Special course requirements** |
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| **12. Classroom etiquette policy** |
| University policy requires that in order to enhance and maintain a productive atmosphere for education, personal communication devices, such as cellular phones and laptops, are to be disabled in class sessions. |
| **13. Disability policy statement** |
| In compliance with the Americans with Disabilities Act (ADA), students who require special accommodations due to a disability to properly execute coursework must register with the Office for Students with Disabilities (OSD) located in Boca Raton campus, SU 133 (561) 297-3880 and follow all OSD procedures. |
| **14. Honor code policy** |
| Students at Florida Atlantic University are expected to maintain the highest ethical standards. Academic dishonesty is considered a serious breach of these ethical standards, because it interferes with the university mission to provide a high quality education in which no student enjoys unfair advantage over any other. Academic dishonesty is also destructive of the university community, which is grounded in a system of mutual trust and place high value on personal integrity and individual responsibility. Harsh penalties are associated with academic dishonesty. See University Regulation 4.001 at [www.fau.edu/regulations/chapter4/4.001\_Code\_of\_Academic\_Integrity.pdf](http://www.fau.edu/regulations/chapter4/4.001_Code_of_Academic_Integrity.pdf) |
| **15. Required texts/reading** |
| Lecture notes provided by instructor. |
| **16. Supplementary/recommended readings** |
| **Elements of Ocean Engineering,** Robert E. Randall, *SNAME,* 1997.**Submersible Vehicle Systems Design,** E.E. Allmendinger, *SNAME,* 1990. |
| **17. Course topical outline, including dates for exams/quizzes, papers, completion of reading** |
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| **Week** |  | **Topic** | **Reading** |
| **1** |   | Class Overview, Facilities & Design Lab Tour |   |
|   | Potential Design Project Overviews/Discussion, PDCD Out |
| **2** |   | Intro to the design process |
|   |   |
| **3** |   |
|   | Team Work & Team Building |
| **4** |   | Scoping & ConOps; Intro to Requirements Definition |   |
|   | System Architecture and Workbreakdown Structure |
| **5** |   | **PDCD Due,** Project Management & Scheduling |
|   | Requirements Definition; PDR Out |   |
| **6** |   | Functional Analysis |
|   | Basic Estimation |
| **7** |   | Trade Studies & Interfaces |   |
|   | Cost & Budgeting |   |
| **8** |   | Project Management & Scheduling |
|   | Catalog Engineering |
| **9** |   | **PDR Due**; Risk & Reliability |   |
|   | CDR Out; Ethics |
| **10** |   | Intro to control |
|   |
| **11** |   | Sensors & Navigation |   |
|   | Intro to Digital Control |   |
| **12** |   |
|   |
| **13** |   | Presentation Skills |   |
|   | **CDR Due** |
| **14** |   | CDR Presentations Dry Runs |
|   | Thanksgiving Break Nov. 22-25 |   |
| **15** |   | **CDR Presentations** |   |
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