Course Syllabus for ENMG 668 - Project and Systems Engineering Management

Update Date: November 25th, 2022

Prepared by: Dr. Jeffrey S. Ray, PMP, CSEP, P.E., Esq.

Prepared for: Dr. Toby Gouker
Program Director
University of Maryland, Baltimore County (UMBC)
College of Engineering and Information Technology

Instructor:
Dr. Jeffrey S. Ray, PMP, CSEP, P.E., Esq.
703-539-0377
jeffray@umbc.edu

Course Prerequisite:
There are no academic prerequisites for this course.

Course Summary Description:
The first three weeks of material addressing the overlap between project management and systems engineering so systems engineering techniques can be leveraged to define a solid programmatic approach. The next 5 weeks address project planning, scheduling and cost estimation techniques. The final 4 to weeks cover project control functions such as Design Review and Evaluation, Configuration, Risk, and Quality Management, and how to manage suppliers. Topics will include:

- An overview of project management and systems engineering
- Defining the systems / life cycle acquisition process and milestone events
- Describing the systems engineering method and requirements management approaches
- Project planning
- Systems Engineering Management (SEM)
- Project Scope Management including the Work Breakdown Structure (WBS)
- Developing the Integrated Master Schedule (IMS)
- Project Pricing and Estimating
- Project Control, Status Reporting, and Earned Value Measurement (EVM) systems
- Design review and evaluation
- Configuration, Risk and Quality Management
- Supplier Management and Contracting.

After the mid-term exam class time will be divided between assigned topics and reviewing subject material relevant to the team project. The team project will involves estimating the cost of a complex international project tasked to develop, integrate, test, and deploy a system

at 10 international locations. Student teams will be handed out a detailed Work Breakdown Structure (WBS) and asked to develop labor estimates for each WBS Work Package, and material costs in the form of a Bill of Materials (BOM) spreadsheet, and then develop a Cost Estimate with a cost summary table.

The class will then cover several periods of advanced topics including how to set up a configuration and information management capabilities on a project, risk and quality management, and the importance of design review and system evaluation.

A class period will then be dedicated to in class team presentations of their class project materials. The course ends with a class period dedicated to reviewing course material in preparation for the final exam. An online Final Exam will be given during the scheduled exam period for the course.

Course Textbooks:

1. Blanchard, B.S., Blyer, J.E., System Engineering Management, 5th Ed., John Wiley & Sons, Hoboken, NJ, ISBN 9781119047827, 2016.
2. Eisner, H., Essentials of Project and Systems Engineering Management, 3rd Ed., John Wiley & Sons, Hoboken, NJ, ISBN 0-471-14846-6, 2008.

Course (Grading) Format:

This class can be taught in the hybrid mode where every other week is done online, or as an in person offering where we meet one evening a week for 150 minutes for 16 weeks. As a result of COVID19 impacts, the course is also being offered in and totally online format. Grades will be computed as follows:

- Class Participation: 20%
- Practice Quizzes 0%
- Mid-Term Exam 25%
- Team Project 20%
- Final Exam 35%.

Instructional Approach:

Instructor presentations, pre-recorded video lectures, assigned readings, topical quizzes and homework are focused on developing skills to stand up the project control function and integrate systems engineering concepts to ensure development of effective management skills. For hands-on practice and reinforcement each student will be engaged in a team project. Students will form teams and receive an abbreviated SOW and be asked to prepare a project plan for conducting the work. Planning and costs estimates to be submitted must account for all aspects of project implementation throughout the complete life cycle of the systems acquisition and operational phases.

Student Learning Objectives:

The primary objective of the course is to demonstrate the critical relationship and interconnection between project management and systems engineering management. This

course will complement existing UMBC PM and SE courses and address how systems engineering management supports traditional program management activities to break down complex programs into manageable and assignable tasks. This course will prepare students for handling the responsibilities of Control Account Managers (CAMs) regarding how to plan, set up cost accounts, bid, staff and execute a project from a project control perspective.

Specific Student Learning Outcomes (SLOs) include:

1. Comprehension. For students to demonstrate an understanding of the relationship between project management and systems engineering.
2. Synthesis. For students to compile component ideas of a plan into a new whole project plan for the execution of large, complex, projects and ensure all aspects of the project are addressed and adequately funded.
3. Analysis. For students to analyze and breakdown a project into a Work Breakdown Structure (WBS) of simpler parts, call Work Packages, and examine components of a complex project in terms of these manageable work units.
4. Application. For students to apply the knowledge gained from project planning to actual situations and create a project schedule that maps and relates to the program's WBS.
5. Evaluation. For students to make and defend project planning decisions based on the Integrated Master Schedule (IMS) and estimate the total cost of the project, and the cost of each work package, and stand up the project control function (i.e., distribute funds into cost accounts) to facilitate execution of large, complex, projects.

To accomplish these learning outcomes the course consists of reading assignments, in class and on-line class lectures, lecture briefing slides with content summarizing course concepts, video recordings of your professor going over the lecture slides, an on-going illustrative class example project used to demonstrate course concepts, an assigned class project which includes hard copy deliverables as well as group presentations, course quizzes, a mid-term examination, and a final examination.

To facilitate tracking the student's accomplishment of course objectives, examinations have been broken into question groups allocated to course goals. Table 1 contains a mapping of course activities, examinations and assignments / deliverables to the course Student Learning Objectives (SLOs) defined above. Each student will be graded against a minimum standard of performance at accomplishing the course objectives. Evidence of SLO accomplishment is established by a series of rubrics for each SLO. The method of collecting evidence for each SLO is addressed individually below.

1. SLO 1 (Relationship between SE and PM). The Question Group for SLO #1 includes several sets of exam questions designed at assessing the student's theoretical understanding of course concepts, as well as a class project deliverable to demonstrate a student's practical understanding of the same concepts. The questions allocated to SLO 1 (for students to understand the relationship between project management and systems engineering) include:

- Quiz #1: Questions: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12.
- Quiz #7: Questions: 9.
- Mid Term: Questions 1, 2, 10, 11, 17, 21, 23, 24.
- Final Exam: Questions 5, 9, 11, 14, 18, 23, 28, 30, 31, 33.

Table 1. Mapping of Course Activities and Deliverables to Course Goals.

	Student Learning Objectives (SLOs)				
Supporting Evidence	**SLO 1** **For students to demonstrate an understanding of the relationship between project management and systems engineering.**	**SLO 2** **For students to compile component ideas of a plan into a new whole project plan for the execution of large, complex, projects and ensure all aspects of the project are addressed and adequately funded.**	**SLO 3** **For students to analyze and breakdown a project into a WBS of simpler parts, call Work Packages, and examine components of a complex project in terms of these manageable work units.**	**SLO 4** **For students to apply the knowledge gained from project planning to actual situations and create a project schedule that maps and relates to the program's WBS.**	**SLO 5** **For students to make and defend project planning decisions based on the IMS and estimate the total cost of the project and stand up the project control function (i.e., distribute funds into cost accounts) to facilitate execution of large, complex, projects.**
Textbook Reading Assignments					
Blanchard (2008)	Chapter 1, 2	Chapter 5, 7, Section 6.2	Section 6.2.4	Section 6.2.7	Section 6.2.8, 6.2.9, 8
Eisner (2008)	Chapter 1, 2, 7	Chapter 3	Section 3.3	Section 4.1, 4.2	Section 3.7, 4.3, 4.4
Class Lectures and Lecture Slides					
Unit 01 Overview of PM and SE (Theory)	☑				
Unit 01 Today's Project Challenges (Theory)		☑			
Unit 02 Life Cycle Acquisition Process (LCAP) (Theory)	☑	☑			
Unit 02 The Systems Engineering Process (Theory)	☑	☑			
Unit 03 Requirements Management (Theory)	☑				
Unit 03 Systems Engineering Essentials (Theory)	☑	☑			
Unit 04 Project Planning (Theory)		☑			
Unit 04 Hunter Testbed Class Exercise (Practical Application)		☑	☑		
Unit 05 The WBS (Theory)		☑	☑	☑	☑
Unit 06 Project Scheduling (Theory)		☑		☑	☑
Unit 08 Project Pricing and Estimating (Theory)			☑		☑
Unit 09 Project Status Reporting (Theory)					☑
Unit 10 Design Review and Evaluation (Theory)					☑
Unit 10 Systems Engineering Management (Theory)	☑	☑			
Unit 11 Organizational Structures (Theory)		☑			
Unit 12 CM / IM (Theory)		☑			
Ongoing Mighty Mouse Sample Class Project					
Mighty Mouse LCAP (Practical Application)	☑				
Mighty Mouse Systems Architecture (Practical Application)	☑				
Mighty Mouse Functional Decomposition (Practical Application)	☑				
Mighty Mouse CDRLs Table (Practical Application)		☑			
Mighty Mouse WBS (Practical Planning Application)			☑		☑
Mighty Mouse Project Schedule (Practical Application)				☑	☑
Mighty Mouse Estimate-At-Completion (Practical Application)					☑
Mighty Mouse Organization Chart (Practical Application)		☑			
Course Quizzes:					
Quiz #1 (Leveraging SE)	☑				
Quiz #2 (Project Planning)		☑			
Quiz #3 (Decomposing WBS)			☑		
Quiz #4 (Project Scheduling)				☑	
Quiz #5 (Cost Estimation and Control)					☑
Quiz #6 (Implementing EVM)					☑
Quiz #7 (Organizational Structures / Course Summary)	☑	☑	☑		☑
Quiz #8 (Planning / Executing RM)		☑			☑
Mid-Term Exam					
Question Group for Leveraging SE	☑				
Question Group for Project Planning		☑			
Question Group for Decomposing WBS			☑		
Question Group for Scheduling Techniques				☑	
Class Project					
LCDP Milestone Schedule Deliverable (Practical Application)	☑				
CDRL Deliverables Table Submission (Practical Application)		☑			
Project WBS Deliverable (Practical Application)			☑		
Project Schedule Submission (Practical Application)				☑	
Project JN/WBS Funding Allocations (Practical Application)					☑
Project EVM Implementation (Practical Application)					☑
Final Exam					
Question Group for Leveraging SE	☑				
Question Group for Project Planning		☑			
Question Group for Decomposing WBS			☑		
Question Group for Scheduling Techniques				☑	
Question Group for Cost Estimating and Project Control					☑
Question Group for Status Reporting and EVM					☑

Collectively, students must obtain a score of 70% or better on these 31 questions to satisfactorily meet this SLO. In addition, students will participate in a team project where they are responsible for developing the following deliverable:

- Class Project: LCAP milestone schedule.

The Life Cycle Acquisition Process (LCAP), commonly referred to as the Systems Acquisition Process (SAP), will demonstrate a student's practical knowledge with respect to taking a complex project, dividing it into phases separated by milestone events, and defining the LCAP in a milestone schedule to be delivered as part of the class project.

2. Goal 2 (Project Planning). The Question Group for SLO #2 includes several sets of exam questions designed at assessing the student's theoretical understanding of course concepts, as well as a class project deliverable to demonstrate a student's practical understanding of the same concepts. The questions allocated to SLO 2 (for students to learn how to plan complex projects and ensure all aspects of the project are addressed and adequately funded) include:

   - Quiz #2: Questions: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10.
   - Quiz #7: Questions 2, 3, 7, 8, 10.
   - Mid Term: 4, 5, 6, 14, 15, 16, 18, 19, 20, 22, 25.
   - Final Exam: 1, 2, 3, 6, 10, 12, 13, 25, 29, 34, 35.

   Collectively, students must obtain a score of 70% or better on these 37 questions to satisfactorily meet this SLO. In addition, students will participate in a team project where they are responsible for developing the following deliverable:

   - Class Project: CDRL Deliverables Table.
   - Class Project: Organizational Breakdown Structure (OBS).

   The Contractor Data Requirements List (CDRL) Deliverables Table will demonstrate a student's practical knowledge with respect to taking a complex project, dividing it into phases separated by milestone events, and assigning deliverables to Control Account Managers (CAMs) by milestone events. Defining the deliverables each CAM has to produce at each milestone will facilitate development of a project schedule that doesn't leave out milestone entry and exit criteria. The Organizational Breakdown Structure (OBS) will demonstrate a student's practical knowledge with respect to developing an organizational approach for a complex project.

3. SLO 3 (Decomposing WBS). The Question Group for SLO #3 includes a group of exam questions designed at assessing the student's theoretical understanding of course concepts, as well as a class project deliverable to demonstrate a student's practical understanding of the same concepts. The questions allocated to SLO 3 (for students to understand how a WBS can break down a complex project into manageable work units) include:

   - Quiz #3: Questions: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12.
   - Quiz #7: Question 4.
   - Mid Term: 3, 7, 8, 12, 13.
   - Final Exam: 7, 8, 20, 22.

Collectively, students must obtain a score of 70% or better on these 22 questions to satisfactorily meet this goal. In addition, students will participate in a team project where they are responsible for developing the following deliverable:

- Class Project: WBS.

The Work Breakdown Structure (WBS) will demonstrate a student's practical knowledge with respect to decomposing a project into work units that can be readily planned by intuitively listing activities, resources, and labor and material estimates necessary to complete each package.

4. SLO 4 (Project Scheduling). The Question Group for Goal #4 includes a set of exam questions designed at assessing the student's theoretical understanding of course concepts, as well as a class project deliverable to demonstrate a student's practical understanding of the same concepts. The questions allocated to SLO 4 (for students to learn how to create a project schedule that maps to the program's WBS) include:

   - Quiz #4: Questions: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10.
   - Mid Term: 9, 26, 27, 28, 29, 30.
   - Final Exam: 32, 43, 44, 45.

   Collectively, students must obtain a score of 70% or better on these 20 questions to satisfactorily meet this SLO. In addition, students will participate in a team project where they are responsible for developing the following deliverable:

   - Class Project: Project Schedule.

   The project schedule will demonstrate a student's practical knowledge with respect to inputting a program's work breakdown structure into the schedule, adding the activities required to complete each work package, and then resource loading the schedule so a cost estimate can be determined.

5. SLO 5 (Cost Estimating and Control). The Question Group for SLO #5 includes a set of exam questions designed at assessing the student's theoretical understanding of course concepts, as well as a class project deliverable to demonstrate a student's practical understanding of the same concepts. The questions allocated to SLO 5 (for students to understand how to estimate cost and stand up a project control function to facilitate execution of large complex projects) include:

   - Quiz #5: Questions: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10.
   - Quiz #6: Questions: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10.
   - Quiz #7: Questions 1, 5, 6.
   - Quiz #8: Questions: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12.
   - Mid Term: NA
   - Final Exam: : 4, 15, 16, 17, 19, 21, 24, 26, 27, 36, 37, 38, 39, 40, 41, 42.

Collectively, students must obtain a score of 70% or better on these 47 questions to satisfactorily meet this SLO. In addition, students will participate in a team project where they are responsible for developing the following deliverable:

- Class Project: Cost estimate rolled up through WBS.
- Class Project: EVM approach integrated into the project schedule.
- Class Project: Incorporation of tasks into the IMS implementing a RM approach.

The project cost estimate rolled up through the WBS will demonstrate a student's practical knowledge with respect to setting up job numbers with funding amounts determined by WBS cost estimates for the corresponding work packages being addressed. The students will also demonstrate a Earned Value Measurement (EVM) status reporting approach and a risk management approach into the project schedule.

Detailed Course Description:
This course will begin with a series of lectures aimed at instilling project control and startup capabilities by combining traditional project management techniques with those of systems engineering management. All topics are covered from the perspective of how it is useful with regards to improving our ability to plan and execute projects. Session by session class descriptions include:

Session 1.1 - Overview of Project Management and Systems Engineering.
[Reading assignment: Eisner Chapter 1, 2.1 – 2.4 (48 pgs.)]

This module will cover the essentials of systems, projects and management in terms of the systems engineering approach for laying out and establishing management controls for a systems acquisition effort. The class will review the elements of systems engineering, the PMBOK, the typical problems that arise when managing complex problems, and how systems engineering can be used to counteract the problems. Students will engage in a class discussion attempting to identify and resolve problems associated with acquiring complex systems, and the challenges associated with today's projects. The relationship between project management and systems engineering will be explored and the overlap in the project control function will be discussed in detail.

Session 1.2 – The LCAP.
[Reading assignment: Blanchard 1.3, 1.5 (18 pgs.)

In this module students divide a project into phases separated by milestone events that allow the Life Cycle Acquisition Process (LCAP) to be defined. It identifies the typical milestone events that are used to capture the design configuration. More importantly, it investigates the decisions that are available to the systems engineer and how to allocate or spread out those decisions across the key milestone events in the form of entry and exit criteria. All the design reviews (conceptual, preliminary, detailed), test events (developmental, integration, operational), logistics demonstrations, configuration audits, etc., will be reviewed in terms of their purpose, the material reviewed, decisions to be made, entry and exit criteria, and the significance of approval and proceeding to the next phase. The class will review a sample life cycle acquisition process drawing and note the relationship between Systems Engineering, Design Engineering and Test activities as the acquisition effort proceeds through the design and into the manufacturing and operational phases. Separating success criteria by life cycle phases ensures the effective use of the project's products (Kang & Moe, 2008). Students will be given an in-class example where they develop a systems acquisition process for a sample project. This on-going sample project will be used as the course progresses to demonstrate course concepts as they are introduced.

Session 2 – The Systems Engineering Process.
[Reading assignment: Blanchard Chapter 2 (69 pgs.)]

This module describes the systems engineering process and methodology used for the acquisition of complex systems. The difficulties that result from the concurrent, iterative, decomposition that has to be accomplished when we apply SE to complex programs is addressed, and how to apply the SE methodology, which includes Requirements Decomposition, Functional Analysis and Allocation, Design Synthesis and Systems Architecting, at each phase of the LCAP. The purpose is to instruct students on the SE methodology and get them used to applying the materialization and visualization techniques necessary to define the necessary equipment items that will comprise the acquired system.

Session 3.1 – System Design Requirements.
[Reading assignment: Blanchard 3.1, 3.2, 3.3, 3.5 (35 pgs.)]

The module addresses the key concepts of requirements management as the activities that review an existing set of requirements, derive new requirements, and then allocate these requirements to the functional elements of the system. After the Requirements Analysis and Allocation (RA&A) effort is conducted in support of the system decomposition, the project ends up with a nice set of performance requirements tailored for lower-level configuration items they have been allocated to. These performance requirements (due to the restatement that goes on) are said to be interpretations of, and not replacements for, the operational requirements. In this module students notice that as they evolve, requirements go from stating

what the system must do, to defining how well the system must do it. Additionally, Project Managers must understand how this work will be performed if they are to accurately capture it in their project plans.

Session 3.2 – Functions and Architecture.
[Reading assignment: Eisner Chapter 7 (42 pgs.)]

In this module students evaluate how functional analysis and allocation (FA&A) activities are conducted to support the functional decomposition and the selection of a valid design concept. While FA&A tasks are required in all of the phases, it is most prevalent in the Concept Exploration and Design Phases. The decisions made in the Concept Definition phase concern the selection of a particular system design configuration, and the definition and grouping of the functions each architectural item is to perform. Functional allocation and decomposition provide insight into the relative merits of each alternative design concept being evaluated. This module concerns learning how to conduct functional analyses for the purpose of evaluating design options.

In this module we also start to get the feel for the architectural structure of the system. As we decompose the functional capabilities our target system will have to perform, we start to think about the equipment items (i.e., hardware, software) that will be needed to accomplish these sub-function capabilities. These items of equipment are organized into subsystems within a defined structure. This structure is called "Architecture." It represents the structure of the equipment items responsible for accomplishing allocated functional capabilities.

Session 4.1 – Project Planning.
[Reading assignment: Eisner 3.1 – 3.4, 3.6 (13 pgs.)]

In this module students analyze and breakdown a project by examining how to conduct the planning required before the project control function can be effectively set up. Topics include:

- Preparing Project Management Plans (PMPs)
- Reviewing/preparing Statement of Works (SOWs) (B., S.6.2.1)
- Estimating the labor required for each SOW paragraph.

Session 4.2 –SE Management (SEM).
[Reading assignment: Blanchard 6.2.2, 6.2.3, 6.2.5, 6.2.6 (17 pgs.)]

In this module students investigate the programmatic aspects of systems engineering by addressing the Systems Engineering Management (SEM) topic. Since the Systems Engineer is responsible for the technical decisions related to how the systems architecture is structured, how the work will be performed, how the system will be modeled, the applications and systems that will be used to articulate the design solution, and how the configuration status and risk posture of the system will be controlled, it is quite natural that they would be involved in how these activities are managed.

At the beginning of the planning effort for a project, the PM and Lead SE have to prepare three major plans: (1) the Project Management Plan (PMP); (2) the Systems Engineering Management Plan (SEMP); and (3) the Test and Evaluation Management Plan (TEMP). In these three plans the entire scope of the project can be analyzed so the project can be estimated with some degree of accuracy. This module will focus on conducting the planning necessary to populate the SEMP. The SEMP complements the PMP and covers all management functions associated with the performance of the technical system engineering activities. It constitutes the plan for identifying and integrating all major engineering activities. The SE activities planned out and identified in the SEMP will ensure that: (1) requirements are developed in a timely manner through a top-down, iterative requirements analysis, (2) system design alternatives are properly evaluated against meaningful quantifiable criteria that relate to desired system characteristics; (3) applicable design disciplines are appropriately integrated into the total engineering effort; (4) overall system development progresses in a logical manner with established configuration baselines, formal design reviews, and proper supporting documentation; and (5) interfaces with other systems are properly considered.

Session 4.3 –Diamond Management Approach.
[Reading assignment: NA]

Although there is no generally accepted framework defining how to do so, different projects have different requirements and should be managed in different ways. Knowing how work will be managed affects project planning. Companies tend to manage project after project with their same project management approach, despite the fact each project is unique and may require a different technical management strategy. Consequently, there is a need for a framework to distinguish among project types, and some practical guidelines on how to manage projects in different ways. Shenhar & Dvir (2007) developed the Diamond Management Framework to evaluate such guidelines. In this module, students become familiar with the Diamond Management approach for analyzing project strategy needs.

Session 5 – Project Scope Management (and the Work Breakdown Structure (WBS)).

[Reading assignment: Blanchard 6.2.4, Eisner 3.9 (12 pgs.)]

In this module students analyze and breakdown a project by examining how to conduct the planning required before the project cost control function can be effectively set up. Topics include:

- Mapping SOW paragraphs to WBS elements
- Defining the Work Breakdown Structure (WBS) (B., S.6.2.4)
- Estimating Cost baselines, setting up cost/control accounts and establishing budgets
- Cost analysis and budget monitoring (Eisner sections 3.7 and 4.3).

Session 6 – Project Scheduling
[Reading assignment: Blanchard Section 6.2.7 (14 pgs.), Eisner 3.5, 4.1 - 4.2 (6 pgs.)]

This module describes how an Integrated Master Schedule (IMS) is constructed and how to capture all elements of the project, including incorporation of:

- Project Management and Control activities into the IMS
- Key project areas by integrating CAM inputs for their respective areas
- Risk mitigation methods into the IMS
- PERT, CPM, 3 point estimating, network constraint diagrams
- Horizontal and Vertical schedule integration
- Activities required to establish a quality assurance program
- Activities required to establish the Configuration Status Accounting (CSA) environment that implements the information systems needed to capture the baseline configuration status of the system
- Schedule uncertainty and 1, 2 and 3 sigma confidence levels
- The PMI (PMBOK's) Time Management processes
- Schedule compression [crashing, fast tracking]
- Sample software integration and test (I&T) schedule
- Inputs required for developing an integrated master schedule (IMS)
- Rolling wave scheduling.

Students will discuss in class the phases for IMS development and how it is updated monthly with task statuses and is the basis for Earned Value Measurement (EVM) reporting to management. The mightyMouse IT sample product development project will be introduced so typical project control items (SOW, WBS, IMS, etc.) can be developed as part of class exercises.

Online Mid-Term Exam
[Reading assignment: None]

Students will be assigned the mid-term exam and have one week to complete it. The exam will be an online exam and taken inside of the BlackBoard course shell. Once a student begins the exam, the must complete it in one sitting, i.e., they cannot work on the exam for an hour and then take a break. So that students can focus on preparing for the mid-term exam, no new material is assigned this week, but the professor will conduct a scheduling workshop to show students how to use the Microsoft Project software application.

Session 7 – Project Pricing and Estimating
[Reading assignment: Blanchard 6.2.8 (4 pgs.), Eisner Chapter 3.7, 4.3, 4.4 (28 pgs.)]

This module will instruct students on how to effectively set up the project cost/control function. Topics include:

- Periodic calculation of Estimate to Complete (ETC).
- Responsibilities of Control Account Managers (CAMs).

- Control accounts as the intersection of the WBS and the Organizational Breakdown Structure (OBS).
- Preparing Basis of Estimates (BOEs) and Bill of Materials (BOMs).
- Estimating Cost baselines, setting up cost/control accounts and establishing budgets
- Cost analysis and budget monitoring (Eisner sections 3.7 and 4.3)
- Management and contingency reserves
- Cost estimating techniques.
- Hosting an Integrated Baseline Review (IBR) where CAMs, their management, and the customer all agree on the budget levels assigned to tasks and the schedule of Contract Data Requirements List (CDRL) deliverables.
- Prepare a table allocating deliverables to CAMs by milestone events.
- Integrating regulatory compliance within the development process.

The module will discuss the conflict between ensuring enough hours are estimated to do the job and being competitive with other bidding companies. Students will participate in an exercise to develop a CDRL matrix that allocates deliverables to CAMs by milestone events.

Session 8 – Project Control and Status Reporting
[Reading assignment: Blanchard Chapter 8. 6.2.9, 6.2.10 (19 pgs.)]

This module describes how cost accounts are set up for a project, the relationships that can be implemented between cost accounts (i.e., job numbers), WBS elements, and major summary tasks on the Integrated Master Schedule (IMS), how to report Earned Value Measurement (EVM) parameters, and how progress reporting will be implemented in general. It will inform students that:

- Earned value measurement systems can be set up in project schedules.
- CAMs have oversight responsibility over each of the WBS elements within their control.
- Integrated Baseline Reviews (IBRs) establish the budgets and schedule constraints imposed on CAMs.
- Periodic audits by the Project Manager and the Program Review Authority (PRA) examine the progress of CAMs, ensuring accountability and transparency.
- CAMs may create Job Numbers (JNs) that track actual costs associated with work performed on major tasks on the Integrated Master Schedule (IMS), which may also correspond to WBS elements.
- CAMs are responsible for preparing monthly status reports that report out progress on assigned tasks.
- Each month a CAM receives a financial report advising of the actual costs accumulated for each JN up until that point. These financial reports give the CAM his actual costs by job number, which corresponds to major tasks on the IMS, and also to WBS elements.

- For each task on the IMS the CAM will make a subjective, but realistic, assessment of percentage complete at the end of each month to assess his budgeted cost of work performed (Earned Value).
- The IMS will combine individual tasks and roll up completion percentages to summary tasks that correspond to job numbers (where costs are collected) and WBS elements.
- For each task on the IMS the CAM will also compute the budgeted cost of work scheduled as of the last re-baseline for this work on the project.
- The CAM reports out the following monthly EVM data to management for each major task, which can be correlated to WBS elements as well as related job numbers:
    - Actual Cost of Work Performed (ACWP).
    - Budgeted Cost of Work Performed (BCWP).
    - Budgeted Cost of Work Scheduled (BCWS).
    - Cost Variance equals the BCWP – ACWP.
    - Schedule Variance equals the BCWP – BCWS.
- Role and function of the Project Review Authority (PRA).
- Using a Balanced Scorecards (Kaplan).
- Cost monitoring and reporting (Eisner, S.4.3.1, 4.3.2).
- Tailoring Microsoft Project to capture EVM data.

The module will discuss how both variances (CV, SV) are reported out in units of dollars. In-class examples will be reviewed to reinforce key aspects of project control and reporting responsibilities. The concept of using a balanced scorecard to monitor progress towards non-financial objectives will also be discussed (Kaplan, 2000).

Session 9 – Design Review and Evaluation
[Reading assignment: Blanchard Chapter 5, 6.1, 6.3 (41 pgs.); Eisner 3.10, 13.3 (11 pgs)]

This module focuses on the importance of formal design reviews and evaluation of the design solution by the customer and, ultimately, the expected users. It will extend the reading assignment and describe typical milestone events that occur, entry and exit criteria, the participants which include representatives across all program areas, and the use of user juries, Integrated Product Teams (IPTs), Interface Control Working Groups (ICWG), as well as how Program Review Authority (PRA) reviews are prepared for and conducted. The class will participate in an exercise to define what the entry and exit criteria are for a few selected key milestone events. The class will also review a PRA briefing to familiarize themselves with the content requirements and the extensive effort that is required to report out progress in a process-oriented organization.

Session 10 –Configuration Management (CM) and Risk Management (RM)
[Reading assignment: Eisner Section 7.3.22 (1 pg.), Blanchard Section 5.4 (5 pgs.), Eisner 3.8, 7.3.9 (6 pgs.), Blanchard 6.7 (6 pgs.)].

This module will define the documents and technical data/drawings that articulate the design and capture the configuration state of the system being acquired. It will describe the Configuration Status Accounting (CSA) databases and client-server information systems that have to be stood up to capture and effectively manage the design, configuration and as-built state of the system. Example systems that could be used to establish the CSA environment will be discussed:

- Document management systems and procedures for assigning document numbers and releasing documents to the customer after appropriate signoffs.
- Tools to manage the Configuration Management (CM) repository of the project like Perforce and ClearCase.
- Problem reporting and tracking tools like Remedy.
- Logistical Support Analysis (LSA) database tools such as SLICWave.
- Engineering drawing management tools like Matrix.
- Requirements traceability tools like DOORS or CORE.

The role that documentation plays in defining/capturing the baseline will be addressed and examples of the following will be summarized: requirement specifications, test plans, interface requirement documents, design description documents, design drawings, the Technical Data Package (TDP), and as-built design modification Engineering Change Proposals (ECPs).

At the beginning of a project, before the architecture has been defined, students will be instructed on how to prepare a document hierarchy describing how the evolving set of requirement baselines will be captured (i.e., Functional, Allocated, Product). After some architectural decisions have been made regarding the systems architecture, students will be instructed to consider how that information can be used to expand the document hierarchy into a complete specification tree. After a baseline is established, it cannot be modified without submission and approval of an ECP. Change management processes and the role of the Change Control Board (CCB) will be discussed, as well as how you structure and use the CM tool to support baseline maintenance (i.e., release branching/labeling). Finally, a Configuration Item Identification (CI Id) numbering system will be discussed.

This module also instructs students on how to standup and implement effective risk management processes.

Session 11 Quality Management
[Reading assignment:

This module instructs students on how to standup and implement effective quality management processes, the role of the Quality Manager in preparing the Quality Assurance Plan (QAP), reviewing and signing off on deliverables as required by the PM, and attending qualification test events as an impartial witness.

Session 12 – Supplier Management & Contracting
[Reading assignment: None]

This module instructs students on how to standup and implement effective supplier management and control processes.

Session 13 – In class Team Presentations of Class Project
[Reading assignment: None]

This module will include the presentation of the class project where each team will present their project deliverables in terms of summarizing their technical design approach, cost innovation, staffing, and, in general, define the choices they made in the bid and how they were made to balance the quality of the design solution against the competitiveness of the total cost.

Session 13 –Final Exam Review
[Reading assignment: None]

The module will end with a module dedicated to reviewing and preparing for the final exam.

Equity & Inclusion Statements –

Accessibility and Disability Accommodations, Guidance and Resources (required)
Accommodations for students with disabilities are provided for all students with a qualified disability under the Americans with Disabilities Act (ADA & ADAAA) and Section 504 of the Rehabilitation Act who request and are eligible for accommodations. The Office of Student Disability Services (SDS) is the UMBC department designated to coordinate accommodations that would create equal access for students when barriers to participation exist in University courses, programs, or activities.

If you have a documented disability and need to request academic accommodations in your courses, please refer to the SDS website at **sds.umbc.edu** for registration information and office procedures.

SDS email: disAbility@umbc.edu

SDS phone: (410) 455-2459.

If you will be using SDS approved accommodations in this class, please contact me (instructor) to discuss implementation of the accommodations. During remote instruction requirements due to COVID, communication and flexibility will be essential for success.

Sexual Assault, Sexual Harassment, and Gender Based Violence and Discrimination (required)

UMBC's **Policy on Sexual Misconduct, Sexual Harassment and Gender Discrimination** and Federal Title IX law prohibit discrimination and harassment on the basis of sex in University programs and activities. Any student who is impacted by sexual harassment, sexual assault, domestic violence, dating violence, stalking, sexual exploitation, gender discrimination, pregnancy discrimination, gender-based harassment or retaliation should contact the University's Title IX Coordinator to make a report and/or access support and resources:

Mikhel A. Kushner, Title IX Coordinator (she/her/hers)

410-455-1250 (direct line), kushner@umbc.edu

You can access support and resources even if you do not want to take any further action. You will not be forced to file a formal complaint or police report. Please be aware that the University may take action on its own if essential to protect the safety of the community.

If you are interested in or thinking about making a report, please see the **Online Reporting Form**. Please note that, while University options to respond may be limited, there is an anonymous reporting option via the online form and every effort will be made to address concerns reported anonymously.

Notice that Faculty are Responsible Employees with Mandatory Reporting Obligations:

All faculty members are considered *Responsible Employees*, per **UMBC's Policy on Sexual Misconduct, Sexual Harassment, and Gender Discrimination.** Faculty are therefore required to report possible violations of the **Policy** to the Title IX Coordinator, even if a student discloses something they experienced before attending UMBC.

While faculty members want you to be able to share information related to your life experiences through discussion and written work, students should understand that faculty are required to report Sexual Misconduct to the Title IX Coordinator so that the University can inform students of their **rights, resources and support**.

If you need to speak with someone in confidence, who does not have an obligation to report to the Title IX Coordinator, UMBC has a number of **Confidential Resources** available to support you:

- The **Counseling Center**: 410-455-2472 / After-Hours 410-455-3230
- **University Health Services**: 410-455-2542
- Pastoral Counseling via **Interfaith Center**: 410-455-3657; interfaith@umbc.edu

Other Resources:

- **Women's Center** (for students of all genders): 410-455-2714; womenscenter@umbc.edu.
- **Shady Grove Student Resources**, **Maryland Resources**, **National Resources**.

Child Abuse and Neglect

Please note that Maryland law and **UMBC policy** require that I report all disclosures or suspicions of child abuse or neglect to the Department of Social Services and/or the police.

Pregnancy

UMBC's **Policy on Sexual Misconduct, Sexual Harassment and Gender Discrimination** expressly prohibits all forms of Discrimination and Harassment on the basis of sex, including pregnancy. **Resources for pregnant students** are available through the University's Office of Equity and Inclusion. Pregnant and parenting students are encouraged to contact the Title IX Coordinator to discuss plans and assure ongoing access to their academic program with respect to a leave of absence or return following leave related to pregnancy, delivery, or the early months of parenting.
In addition, students who are pregnant may be entitled to accommodations under the ADA through the **Student Disability Service Office**, and/or under Title IX through the **Office of Equity and Inclusion**.

Religious Observances & Accommodations

UMBC **Policy** provides that students should not be penalized because of observances of their religious beliefs, students shall be given an opportunity, whenever feasible, to make up within a reasonable time any academic assignment that is missed due to individual participation in religious observances. It is the responsibility of the student to inform the instructor of any intended absences for religious observances in advance, and as early as possible. For questions or guidance or to request an accommodation, please contact the **Office of Equity and Inclusion** at **oei@umbc.edu**.

Hate, Bias, Discrimination and Harassment

UMBC values safety, cultural and ethnic diversity, social responsibility, lifelong learning, equity, and civic engagement.

Consistent with these principles, **UMBC Policy** prohibits discrimination and harassment in its educational programs and activities or with respect to employment terms and conditions based on race, creed, color, religion, sex, gender, pregnancy, ancestry, age, gender identity or expression, national origin, veterans status, marital status, sexual orientation, physical or mental disability, or genetic information. Students (and faculty and staff) who experience discrimination, harassment, hate or bias or who have such matters reported to them should use the **online reporting form** to report discrimination, hate or bias incidents; reporting may be *anonymous.*