Course	ENGR 12800 – Engineering Fundamentals II
Type of Course	Required for all undergraduate engineering programs
Catalog Description	This second course in engineering fundamentals continues the introduction to engineering applications, analysis, experimentation, and design with a focus on the application of mathematical analysis. The course's project studio emphasizes team work, project management, and communication with significant writing and speaking. A laboratory component introduces engineering computer tools for manipulation of data sets and structured programming. The course continues the overview of engineering majors and the engineering profession.
Credits	4
Contact Hours	2 Lecture, 2.5 Project Studio, 2.5 Laboratory
Prerequisite Courses	ENGR 12700 Engineering Fundamentals I
Corequisite Courses	MA 165 ENG W131 or COM 114
Prerequisites by Topics	Trigonometry College entrance level of writing, speaking and critical reading Application of algebra, trigonometry, disruptive statistics and simple derivatives in engineering Preparation of graphs, charts, tables and memos for communication Use of CAD and Spreadsheet software
Textbook	K.S. Rattan and N.W. Klingbeil, *Mathematics for Engineering Applications*, Wiley (2013) plus supplemental materials
Course Objectives	This course seeks to prepare students for the study of engineering through learning how to: 1. effectively approach the study of engineering, 2. rigorously apply of mathematical techniques to engineering problems particularly complex numbers, sinusoidal waves, Boolean logic, simple integration and introductory differential equations, 3. carry out a disciplined engineering project, 4. prepare effective Technical Memo Reports and oral presentations, and 5. use modern software tools to solve problems with well-structured and clearly documented programs.

Course Learning Outcomes

After successfully completing this course, students should be able to:

Lecture

1. formulate and solve engineering problems using complex numbers (a)
2. formulate and solve engineering problems using sign waves & frequency (a)
3. formulate and solve engineering problems using integration (a)
4. formulate and solve engineering problems using Boolean Logic (a)
5. formulate and solve engineering problems using (linear-in-parameters) empirical fitting (a)
6. formulate and solve engineering problems using simple differential equations (a)
7. solve and document the solution of problems involving different configurations (e)
8. solve problems using multiple approaches (e.g., equations including varied analytic approaches, diagrams, formal solution steps or simple computer programs) (e)
9. describe the broad nature of various engineering majors and the engineering profession and use this information to make appropriate career choices. (f)

Studio

1. plan and carry out a disciplined design project following a systematic design process (c)
2. Utilize appropriate analytical and computer tools in project work (k)
3. write a precise and effective Technical Report Memo. Write clear Abstract, Methodology, Recommendations, and Conclusions sections (g)
4. prepare and deliver an effective oral technical presentation (g)
5. organize an effective team including setting ground rules, project planning, and task management; explain and utilize effective group processes (d)

Laboratory

1. solve engineering problems using computer tools (k)
2. apply arrays and array manipulations (k)
3. use and explain files and data structures (k)
4. write a function with multiple inputs and outputs at the command line (k)
5. write a function that results in a non-numerical output
6. write programs using logical expressions and conditional statements (k)
7. write programs using loop structures (k)
8. fit data that follows linear, quadratic, or power law forms (k)
9. properly communicate a solution based on computer calculation or program (k)

Lecture Topics	1. Review of engineering analysis from ENGR 12700 2. Engineering applications of complex numbers 3. Engineering applications of sinusoids and waves 4. Engineering applications of simple integration 5. Engineering applications of Boolean Logic 6. Engineering applications of empirical modeling (linear-in-parameters) 7. Engineering applications of simple differential equations 8. Engineering majors & jobs
Studio Topics	1. Design process 2. Writing technical memo reports 3. Writing abstract, methodology, recommendations, and conclusions sections 4. Oral technical presentations 5. Teamwork
Laboratory Topics	1. Working with arrays and files in computer programs 2. Writing computer functions and sub-functions 3. Writing programs with branching 4. Writing programs with loops 5. Fitting simple empirical models 6. Documenting a computer problem solution
Computer Usage	High
Laboratory Experience	Low
Design Experience	High
Coordinator	S. Scott Moor, Ph.D., P.E. , moors@ipfw.edu (260) 481-6020
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