MAE 1312 – Engineering Statics

Summer 2014

Revised 06/02/2014

Instructor: Baxter R. Mullins, Jr., Ph.D., P.E.

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Office Hours: TH 9:00am – 10:00am and other times by appointment

GTA: TBD

GTA Office Number: TBD

GTA Office Hours: TBD

Section Information: MAE 1312 – 001

Meeting Information: **Days & Time:** TuTh 10:30am – 12:20pm
Room: Woolf Hall (WH) #311
Meeting Dates: June 02, 2014 – August 07, 2014

Emergency Exits: Straight out the door, turn right or left and exit building by stairs. **DO NOT USE ELEVATORS**!

Description of Course Content: MAE 1312 ENGINEERING STATICS (3-0) A study of forces and force systems, resultants and components of force systems, forces due to friction, conditions of equilibrium, forces acting on members of trusses and frame structures, centroids and moments of inertia. Vector and index notation introduced.

Prerequisites: C or better in each of the following MATH 1426 (or HONR-SC 1426) and PHYS 1443C or better in MAE 1312; C or better in MATH 2425 (or HONR-SC 2425).

Student Learning Outcomes: To present the principles of engineering mechanics as it pertains to engineering statics and to the study of forces and force systems, resultants and components of force systems, forces due to friction, conditions of equilibrium, forces acting on members of trusses and frame structures, centroids and moments of inertia, and to introduce the mathematics of vectors and index notation.

Required Textbook: ***Engineering Mechanics - Statics*** by R.C. Hibbeler, 13th ed.

References:

- Pletta, D.H., and Frederick, D., "***Engineering Mechanics: Statics and Dynamics***," The Roland Press Co., New York, 1964.
- Nelson, E., et al., "Schaum's Outline of Engineering Mechanics Dynamics," The McGraw-

Hill Companies, Inc., 2011.
- Anon, "The Mechanics Problem Solver," Research & Education Association; Revised edition, Piscataway, New Jersey, March 5, 1980.
- McMahon, D., "Statics and Dynamics DeMYSTiFeD," The McGraw-Hill Companies, Inc., 2007.

Planned Topics:

- General Principles of Mechanics
- Principles of Archimedes, Galileo, Newton, Euler, D'Alembert, Lagrange, and others.
- Free-body Diagrams
- Analysis Processes and Procedures
- General Analysis and Design Principles
- Force Vectors
- Equilibrium of a Particle
- Force System Resultants
- Equilibrium of a Rigid Body
- Structural Analysis
- Internal Forces
- Friction
- Center of Gravity and Centroid
- Virtual Work
- Moments of Inertia

Description of major assignments and examinations:

Grading System:	Homework (including classroom activities)	20%
	Quizzes	25%
	Mid Term Exam	25%
	Final Examination	30%

Letter Grade/Number Grade correlation:

A (90-100), B (80-89), C (70-79), D (60-69), F (less than 60)

In order to receive a passing grade, the weighted average of the scheduled exams, homework, quizzes, and the final examination must be 60 or above.

Students are expected to keep track of their performance throughout the semester and seek guidance from available sources (including the instructor) if their performance drops below satisfactory levels.

Homework Policy:

- Assigned homework is due at the beginning of the following class meeting.
- Use Engineering Paper for assigned homework problems.
- One problem per page.
- Late homework is accepted only with approval of the instructor.
- All homework handed in for grade will include a statement of the problem, a free body diagram of the mechanism (as appropriate), and an organized solution to the problem.

Exam Policy:

- One tw0-hour mid-term exam is planned for the course. Anticipate weekly quizzes.
- A comprehensive final examination will be given at the conclusion of the course.
- All problems stated in the exams will be weighted equally unless otherwise specified.
- There will be **NO** make-up exams for unexcused absences.
- Missed exams/quizzes will receive a grade of zero unless the student has an excused absence.
- A student having an **UNEXCUSED** absence from the final exam will receive the course grade earned. A student having an **EXCUSED** absence from the final exam has two options:
  a. The student may elect to receive the course grade earned with the final exam grade equal to zero, or
  b. The student may elect to receive the grade of "I" (incomplete) and make arrangements to complete the course by taking the final examination at the end of the next semester.

  If the student chooses the second option, it is the student's responsibility to consult with the instructor regarding completion of the course requirements.

  NOTE: Excuses for absences from the final exam must be in writing with appropriate verification; e.g., note from your doctor, dentist, etc.

Expectations for Out-of-Class Study: The general rule of thumb is for every credit (classroom lecture time per week) hour earned, a student should expect to spend 3-hours per week working outside of class. As this is an 11-week summer course, there are 4-hours of classroom lectures provided each week and students enrolled MAE 1312 should expect to spend at least an additional 12-hours per week of their own time in course-related activities, including reading required materials, completing assignments, preparing for exams, etc.

Attendance: Students taking this course are expected to attend every class, to **arrive on time**, and to stay in class until they are dismissed. Students who fail to adhere to the attendance policy can expect an impact on their grade. Students will not be penalized in the case of an emergency, or an incident beyond the student's control.

Grade Grievances: Any appeal of a grade in this course must follow the procedures and deadlines for grade-related grievances as published in the current undergraduate catalog.

Drop Policy: Students may drop or swap (adding and dropping a class concurrently) classes through self-service in ***MyMav*** from the beginning of the registration period through the late registration period. After

the late registration period, students must see their academic advisor to drop a class or withdraw. Undeclared students must see an advisor in the University Advising Center. Drops can continue through a point two-thirds of the way through the term or session. It is the student's responsibility to officially withdraw if they do not plan to attend after registering. ***Students will not be automatically dropped for non-attendance.*** Repayment of certain types of financial aid administered through the University may be required as the result of dropping classes or withdrawing. For more information, contact the Office of Financial Aid and Scholarships (http://wweb.uta.edu/ses/fao).

Americans with Disabilities Act: The University of Texas at Arlington is on record as being committed to both the spirit and letter of all federal equal opportunity legislation, including the ***Americans with Disabilities Act (ADA)***. All instructors at UT Arlington are required by law to provide "reasonable accommodations" to students with disabilities, so as not to discriminate on the basis of that disability. Any student requiring an accommodation for this course must provide the instructor with official documentation in the form of a letter certified by the staff in the Office for Students with Disabilities, University Hall 102. Only those students who have officially documented a need for an accommodation will have their request honored. Information regarding diagnostic criteria and policies for obtaining disability-based academic accommodations can be found at www.uta.edu/disability or by calling the Office for Students with Disabilities at (817) 272-3364.

Academic Integrity: All students enrolled in this course are expected to adhere to the UT Arlington Honor Code:

> *I pledge, on my honor, to uphold UT Arlington's tradition of academic integrity, a tradition that values hard work and honest effort in the pursuit of academic excellence.*
>
> *I promise that I will submit only work that I personally create or contribute to group collaborations, and I will appropriately reference any work from other sources. I will follow the highest standards of integrity and uphold the spirit of the Honor Code.*

Instructors may employ the Honor Code as they see fit in their courses, including (but not limited to) having students acknowledge the honor code as part of an examination or requiring students to incorporate the honor code into any work submitted. Per UT System Regents' Rule 50101, §2.2, suspected violations of university's standards for academic integrity (including the Honor Code) will be referred to the Office of Student Conduct. Violators will be disciplined in accordance with University policy, which may result in the student's suspension or expulsion from the University.

> ***All work turned in for credit must be the results of the student's own efforts. The penalties for dishonesty could result in a zero for the work turned in, an F in the course, or possibly dismissal from the university.***

Student Support Services: UT Arlington provides a variety of resources and programs designed to help students develop academic skills, deal with personal situations, and better understand concepts and information related to their courses. Resources include tutoring, major-based learning centers, developmental education, advising and mentoring, personal counseling, and federally funded programs. For individualized referrals, students may visit the reception desk at University College (Ransom Hall), call the Maverick Resource Hotline at 817-272-6107, send a message to resources@uta.edu, or view the information at www.uta.edu/resources.

Electronic Communication: UT Arlington has adopted *MavMail* as its official means to communicate with students about important deadlines and events, as well as to transact university-related business regarding financial aid, tuition, grades, graduation, etc. All students are assigned a *MavMail* account and are responsible for checking the inbox regularly. There is no additional charge to students for using this account, which remains active even after graduation. Information about activating and using *MavMai*l is available at http://www.uta.edu/oit/cs/email/mavmail.php.

Student Feedback Survey: At the end of each term, students enrolled in classes categorized as lecture, seminar, or laboratory shall be directed to complete a Student Feedback Survey (SFS). Instructions on how to access the SFS for this course will be sent directly to each student through *MavMail* approximately 10 days before the end of the term. Each student's feedback enters the SFS database anonymously and is aggregated with that of other students enrolled in the course. UT Arlington's effort to solicit, gather, tabulate, and publish student feedback is required by state law; students are strongly urged to participate. For more information, visit http://www.uta.edu/sfs.

Final Review Week: A period of five class days prior to the first day of final examinations in the long sessions shall be designated as *Final Review Week*. The purpose of this week is to allow students sufficient time to prepare for final examinations. During this week, there shall be no scheduled activities such as required field trips or performances; and no instructor shall assign any themes, research problems or exercises of similar scope that have a completion date during or following this week unless specified in the class syllabus. During *Final Review Week*, an instructor shall not give any examinations constituting 10% or more of the final grade, except makeup tests and laboratory examinations. In addition, no instructor shall give any portion of the final examination during *Final Review Week*. During this week, classes are held as scheduled. In addition, instructors are not required to limit content to topics that have been previously covered; they may introduce new concepts as appropriate.

Course Schedule:

Summer Term – 11-week Session, 2014 (11 meeting weeks: 10 instructional weeks + 1 final exam week)

First day of classes:	June 2, 2014
Census Date:	June 19, 2014
Last day to drop classes:	June 17, 2014
Last day of classes:	August 7, 2014
Final Exam	August12, 2014 (10:30 am – 12:30pm)

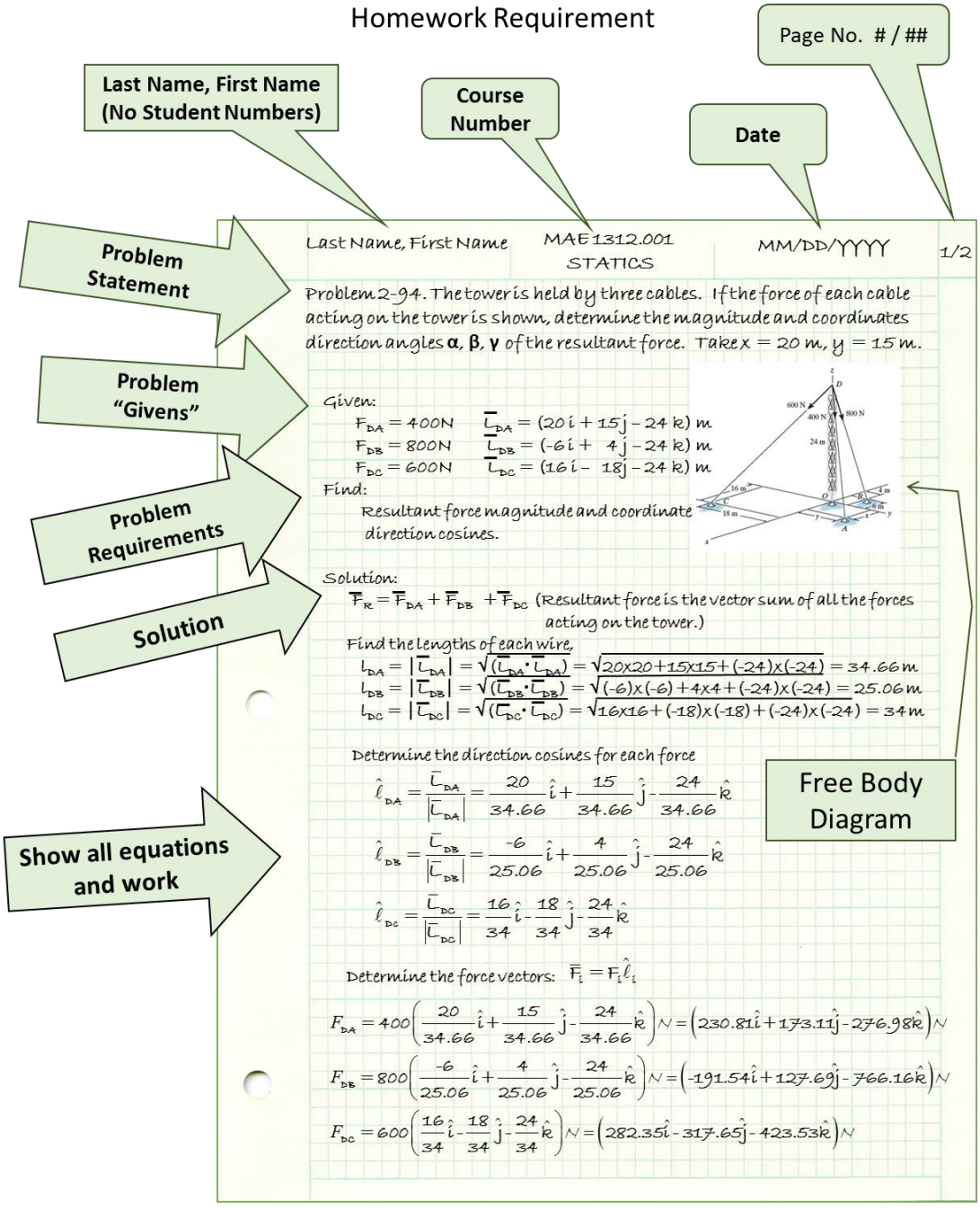
"As the instructor for this course, I reserve the right to adjust this schedule in any way that serves the educational needs of the students enrolled in this course – Baxter R. Mullins, Jr."

HOMEWORK ASSIGNMENTS (Other Assignments may be provided in class.)

MAE 3301.001 ENGINNERING DYNAMICS								
							5/15/2014	
WEEK	DATE		CLASS	ASSIGNMENTS				NOTES
				READING			PROBLEMS	
#1	Tue	06/03/14	1	Chap #1	PREFACE Sect 1.1 - 1.6	pp vii -xviii pp 1-14	1-9, 1-20	
			2	Chap #2	Sect 2.1 - 2.4	pp 17 - 27, 32 - 38	2-7, 2-13, 2-37	
	Thu	06/05/14	3	Chap #2	Sect 2.5 - 2.6	pp 43 - 51	2-70, 2-94	
			4	Chap #2	Sect 2.7 - 2.8	pp 56 - 63	2-88, 2-110	
#2	Tue	06/10/14	5	Chap #2	Sect 2.9	pp 69 -74, 79 -81	2-117, 2-139	
			6	Chap #3	Sect 3.1 - 3.3	pp 85 - 94	3-11, 3-17	
	Thu	06/12/14	7	Chap #3	Sect 3.4	pp 103 - 108, 113	3-57, 3-62	
			8	Chap #4	Sect 4.1 - 4.3	pp 118 - 127	4-7, 4-19	
#3	Tue	06/17/14	9	Chap #4	Sect 4.4 -4.5	pp 128 - 132, 139 - 144	4-53, 4-65	
			10	Chap #4	Sect 4.6	pp 148 - 154	4-75, 4-80	
	Thu	06/19/14	11	Chap #4	Sect 4.7 - 4.8	pp 160 - 166, 170 - 178	4-103,4-118	
			12	Chap #4	Sect 4.9	pp 183 - 188, 193 - 197	4-139, 4-144	
#4	Tue	06/24/14	13	Chap #5	Sect 5.1 - 5.2	pp 199 - 210	5-1, 5-8	***TABLE 5-1****
			14	Chap # 5	Sect 5.3 - 5.4	pp 214 - 226	5-14, 5-24	
	Thu	06/26/14	15	Chap # 5	Sect 5.5 - 5.6	pp 237 - 242	5-65, 5-70	
			16	Chap # 5	Sect 5.7	pp 243- 252	5-75, 5-81	
#5	Tue	07/01/14	17	Chap #6	Sect 6.1 - 6.3	pp 263 - 275	6-7, 6-17	
			18	Review	Chap 1 - 5			
	Thu	07/03/14	19	MIDTERM	2 HOUR MIDTERM			
			20	MIDTERM				
#6	Tue	07/08/14	21	Chap #6	Sect 6.4 - 6.5	pp 280 - 286, 290-291	6-34, 6-55	
			22	Chap #6	Sect 6.6	pp 294 - 312, 325 -327	6-61, 6-76	
	Thu	07/10/14	23	Chap #6	Problem Session		6-121, 6-126	
			24	Chap #7	Sect 7.1 - 7.2	pp 331 - 339, 347 -351	7-18, 7-53, 7-57	
#7	Tue	07/15/14	25	Chap #7	Sect 7.3	pp 356 - 362	7-83, 7-89	
			26	Chap #7	Sect 7.4	pp 367 - 377, 382 -384	7-101, 7-106, 7-121	
	Thu	07/17/14	27	Chap #8	Sect 8.1 - 8.2	pp 390 - 403	8-2, 8-15, 8-35	
			28	Chap # 8	Sect 8.3 - 8.4	pp 416 - 420	8-59, 8-66	
#8	Tue	07/22/14	29	Chap #8	Sect 8.5 - 8.6	pp 425 - 427, 433 - 435	8-85,8-109	
			30	Chap #8	Sect 8.7	pp 436 - 439, 445 - 447	8-116, 8-130	
	Thu	07/24/14	31	Chap #9	Sect 9.1	pp 451 - 465	9-5, 9-10, 9-50	
			32	Chap #9	Sect 9.2 - 9.3	pp 474 - 479, 488 - 492	9-55, 9-88, 9-113	
#9	Tue	07/29/14	33	Chap # 9	Sect 9.4 - 9.5	pp 497 - 505, 509 -511	9-115, 9-129	
			34	Chap #10	Sect 10.1 -10.3	pp 515 - 522	10-6, 1-22	
	Thu	07/31/14	35	Chap #10	Sect 10.4 - 10.7	pp 526 - 529, 534 -543	10-35, 10-41, 10-65	
			36	Chap #10	Sect 10.8	pp 549 - 565, 562 -563	10-82, 10-83, 10-107	
#10	Tue	08/05/14	37	Chap #11	Sect 11.1 - 11.4	pp 567 - 576, 583 - 584	11-1, 11-10, 11-12	
			38	Chap #11	Sect 11.5 - 11.7	pp 584 - 592, **598 - 599***	11-29, 11-37,11-44	
	Thu	08/07/14	39	Review Chapters 1 - 5				
			40	Review Chapters 6 - 11				
#11	Tue	08/12/14	Final	FINAL	2 HOUR FINAL EXAM			

HOMEWORK REQUIREMENT:

1. Homework will be turned in on Engineering Paper
2. Each problem will begin on a separate sheet of Engineering Paper
3. Work will be neat and readable – No. 2 pencil or ink is acceptable
4. Format for homework paper is as follows:



Homework Requirement

Repeat Name

Course Number

Repeat Date

Next Page No. # / ##

Last Name, First Name | MAE1312.001 STATICS | MM/DD/YYYY | 2/2

Now,

$$\bar{F}_R = \bar{F}_{DA} + \bar{F}_{DB} + \bar{F}_{DC}$$
$$= \{321.66\hat{i} - 16.82\hat{j} - 1466.71\hat{k}\}\,N$$

The resultant force is:

$$F_R = \sqrt{\bar{F}_R \cdot \bar{F}_R} = \sqrt{(321.66)^2 + (-16.82)^2 + (-1466.71)^2}\,N$$
$$= 1501.66\,N = 1.50\,kN$$ Ans.

Show all equations and work

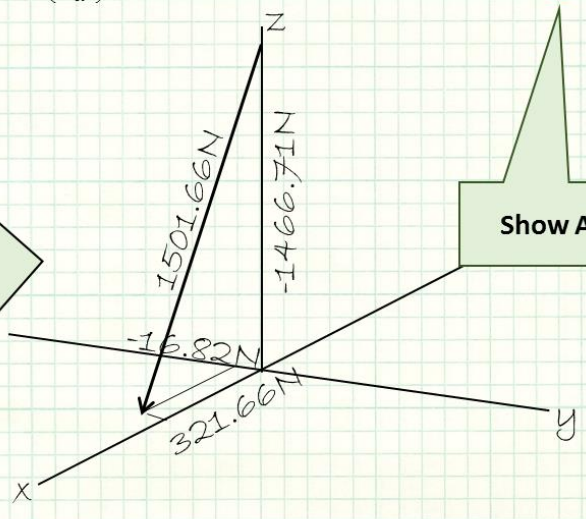
and the direction cosines are

$$\alpha = \cos^{-1}\left(\frac{F_{R_X}}{F_R}\right) = \cos^{-1}\left(\frac{321.66}{1501.66}\right) = 77.6^\circ$$ Ans.

$$\beta = \cos^{-1}\left(\frac{F_{R_Y}}{F_R}\right) = \cos^{-1}\left(\frac{-16.82}{1501.66}\right) = 90.6^\circ$$ Ans.

$$\gamma = \cos^{-1}\left(\frac{F_{R_Z}}{F_R}\right) = \cos^{-1}\left(\frac{-1466.71}{1501.66}\right) = 167.6^\circ$$ Ans.

Final Sketch as necessary for completeness



Show Answers