1: Course Number and Name
   a. MENG 3411: Heat Transfer, Spring 2020
   b. Section 010, MWF 10:00 – 10:50 pm

2: Credits and Contact Hours
   a. Credits: 4
   b. Contact Hours: 3 hours/week (Classroom) 3/hours/week (Lab)

3: Instructor Information
   a. Course Coordinator: Manuel Garcia
   b. Instructors:
      i. Manuel García, 325-486-5515, manuel.garcia@angelo.edu. Office: VIN 274. For office hours see faculty homepage.

4: Required Course Materials

5: Technology Requirements
   To successfully complete this course, you need to WileyPLUS access
   Squarecap is a web-based classroom response application that your instructor will be using during your course for in-class Q&A and verifying your attendance. Use any Wi-Fi capable device, visit http://www.squarecap.com on your web browser.
   Some solutions to homework assignments, quizzes, and exams require the use of Python which is installed in the VDI Server  http://view.angelo.edu
   Online access to the classes via GoogleMeet (Link provided within Blackboard). It requires a web cam.

6: Specific Course Information
   c. Prerequisites: ENGR 2302 and MATH 3324
   d. Required or elective: Required (Engineering Principles)

7: Specific Goals for the Course
   a. Course Learning Outcomes:
      1. Modify the heat diffusion equation in solving heat transfer problems in cartesian, cylindrical, and spherical coordinate systems (SO1)
      2. Solve one-dimensional steady-state and transient heat conduction problems (SO1)
      3. Solve multi-dimensional steady-state and transient heat conduction problems (SO1)
      4. Conduct dimensional analysis to identify dimensionless parameters in HT problems
      5. Solve forced convection problems involving internal and external flows (SO1)
      6. Solve free convection problems (SO1)
      7. Solve radiation heat transfer exchange problems between surfaces (SO1)
8. Apply heat transfer principles to fin design and/or the design of heat exchanger device
9. Being knowledgeable of one or contemporary issues involving heat transfer by doing research projects (SO2, SO3)
10. Use computer software in numerical analysis of heat transfer problems (SO1)
11. Perform experiments concerned with heat transfer (SO1, SO6).
12. Record, process and display experimental data for the purposes of comparison and trend analysis (SO1, SO3, SO6).
13. Determine appropriate report formatting for effective communication of experimental results (SO3).

b. Course Learning Outcome Mapping to ABET Criterion 3 Student Outcomes:

Table 1: Course Learning Outcomes mapped to ABET Student Outcomes

<table>
<thead>
<tr>
<th>ABET Student Outcomes</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
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<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Solve Problems</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<td>2. Design</td>
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<td>X</td>
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<td>3. Communication</td>
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<td>X</td>
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<tr>
<td>4. Ethics &amp; Professionalism</td>
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<tr>
<td>5. Teamwork</td>
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<td></td>
<td></td>
<td>X</td>
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<tr>
<td>6. Experimentation</td>
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<td></td>
<td></td>
<td>X</td>
<td>X</td>
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<tr>
<td>7. Acquire New Knowledge</td>
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</tr>
</tbody>
</table>

8: Topics Covered

1. Derivation of transient multi-dimensional heat equation
2. Analytical solutions to steady-state one-dimensional heat conduction
3. Dimensional analysis
4. Solutions to steady-state two-dimensional heat conduction problems
5. Solutions to transient heat conduction problems
6. Heat transfer by forced convection
7. Heat transfer by free convection
8. Heat exchangers
9. Radiation exchange between surfaces
10. Numerical methods for heat conduction
12. Design projects and formal reports
9: Course Delivery and Communications

9.1: Delivery Method(s)
This is a face-to-face course with learning resources and supplemental materials posted in Blackboard. Classes will be broadcasted for students that are under quarantine. Instructions on how to connect will be posted in Blackboard. Exams will be face to face.

9.2: Communications
Faculty will respond to email and/or telephone messages within 24 hours during working hours Monday through Friday. Weekend messages may not be returned until Monday.

Written communication via email: All private communication will be done exclusively through your ASU email address. Check frequently for announcements and policy changes. In your emails to faculty, include the course name and section number in your subject line.

Virtual communication: Office hours and/or advising may be done with the assistance of BB- Collaborate, or Google Meet.

10: Professionalism
Professional engineering standards apply in this class. You are expected to demonstrate a behavior consistent with the conduct of an individual practicing in the engineering profession. You are expected to: (1) come prepared for class; (2) respect faculty and peers; (3) demonstrate responsibility and accountability for your own actions; (4) demonstrate sensitivity and appreciation for diverse cultures, backgrounds, and life experiences; (5) offer and accept constructive criticism in a productive manner; (6) demonstrate an attitude that fosters professional behavior among peers and faculty; (7) be punctual to class meetings; (8) maintain a good work ethic and integrity; and (9) recognize the classroom as a professional workplace.

11: Graded Material

11.1: Class Attendance, Participation, Timeliness and Teamwork
The number one complaint of engineering clients is the timeliness of deliverables (reports, drawings, specifications, etc.). As a professional engineer you will be expected to arrive at scheduled meetings on time and prepared. Late proposals are not generally accepted. Late specifications or drawings may cost the engineer a monetary penalty. Professional engineering standards apply in this course.

You are expected to meet every class meeting on time and prepared. Attendance will be taken. Should you find it necessary to miss a class for any reason, you are expected to notify your instructor as early as the absence is known—preferably before the absence. It’s important that you communicate clearly your instructors.

Your online assignments will be due at the time specified on WileyPlus. Any assignments submitted in hard copy are due at the beginning of class on the due date. Your instructor may assess penalties for late work.

11.2: Reading Assignments and Homework
You will be given reading and homework assignments nearly every lesson. Reading assignments will come from the assigned textbooks or other materials provided or available via the web. The homework assignments will consist of questions to be answered during your reading and preparation for class. Reading and homework assignments will be distributed via the Blackboard and WileyPlus.
11.3: Quizzes

Instructors may give in-class quizzes. The quizzes will be unannounced and unscheduled. The quizzes are intended to determine whether or not you have completed the pre-class work and are prepared for class.

11.4: Course Exercises

There will be in-class exercises in this course. Participation in exercises is expected from all students. Zero points will be awarded for missed exercises. These exercises cannot be made up.

11.5: Exams

Make-up exams will only be given for extenuating circumstances, unless prior arrangements with the instructor are agreed upon. Proof, such as a doctor’s note or other official document, may be required for unexcused absences during an exam. Approval from the Disability Services office is needed if you are under quarantine due to a close contact or sickness. Please complete the COVID-19 Wellness Screening daily.

Exams will not be open textbook or notes, but a formula sheet will be provided. Details will be discussed closer to the exam time.

11.6: Term Project Reports

There will be three projects assigned in this class. The projects can be completed by group effort (2 people maximum). These reports must be completed clearly and legibly for full credit. The reports will be prepared using a word processor (e.g., Word, Pages, LaTeX). Tables and graphs must also be completed using a software program (e.g. R or Spreadsheet). Any sloppy report that is not formatted correctly will receive reduced credit down to zero credit.

A technical report must include the following sections:

- A cover page that states the title of the report, the author(s) of the report, the course number, the semester, and any other organizational information;
- An abstract or executive summary that presents a short summary and motivation of the entire report (between 100 to 200 words);
- An introduction that provides the purpose, technical background, motivation for the report, and a description of theoretical considerations and an explanation of why those theories and equations are included in the report;
- A detailed procedure that explains the type of data that is being considered, how various probabilistic models were applied to the data set, and any other applied theoretical considerations. This procedure should not be a bulleted list of tasks that done – instead, this procedure must explain what you did using full and complete sentences;
- A results section that includes necessary sample calculations, and graphs, and tables containing major results. Tables/graphs with intermediate calculations, researched data or long computational results should go in the appendix section;
- A discussion that specifically answers the assigned questions given by your instructor where the discussion is supported by theory described in your introduction and supported by data presented in your results section;
- A list of conclusions that is drawn from your results and discussion. Your conclusions must clearly reiterate thoughtful statements and not simply re-state facts; and
• A list of bibliographic references cited in the report. Do not include a referenced not cited in the body of the text

• An appendix that includes additional tables, followed by figures, followed by sample calculations, all listed in numerical order. Numerical order is dictated by the order in which the table, figure, or sample calculation is mentioned in the main body of the technical report. Do not repeat tables or graphs both in the body of text and appendices. Do not include a figures or tables not referenced in the body of the text.

• Do not include handwritten material

In general, your reports must be organized according to this format, sections must be clearly labeled and contain the correct content, grammar and sentence structure must be correct, the overall appearance must be neat and professionally assembled, and the technical content must be correct.

11.7: Grades: Weighting and Letter Grades

The weighting system shown in Table 2 will be used in determining final grade for the course

Table 2: Grade Weighting

<table>
<thead>
<tr>
<th>Item</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homework</td>
<td>12%</td>
</tr>
<tr>
<td>Quizzes</td>
<td>7%</td>
</tr>
<tr>
<td>Laboratories</td>
<td>15%</td>
</tr>
<tr>
<td>Project</td>
<td>15%</td>
</tr>
<tr>
<td>Exams</td>
<td>36%</td>
</tr>
<tr>
<td>Final Exam</td>
<td>15%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

The instructor will determine letter grades for the course using his professional judgment, and the following standards as described in the University Catalog:

A = excellent work  B = good work  C = average work  D = poor work  F = failing work

12: Classroom and University Policies and Student Support

12.1: General Policies

All students are required to follow the policies and procedures presented in the Angelo State University Student Handbook\(^1\) and Angelo State University Catalog\(^2\).

12.2: Student Disability Services

ASU is committed to the principle that no qualified individual with a disability shall, on the basis of disability, be excluded from participation in or be denied the benefits of the services, programs or activities of the university, or be subjected to discrimination by the university, as provided by the Americans with Disabilities Act of 1990 (ADA), the Americans with Disabilities Act Amendments of 2008 (ADAAA) and subsequent legislation.
Student Disability Services is located in the Office of Student Affairs, and is the designated campus department charged with the responsibility of reviewing and authorizing requests for reasonable accommodations based on a disability. It is the student’s responsibility to initiate such a request by contacting an employee of the Office of Student Affairs, in the Houston Harte University Center, Room 112, or contacting the department via email at ADA@angelo.edu. For more information about the application process and requirements, visit the Student Disability Services website. The employee charged with the responsibility of reviewing and authorizing accommodation requests is:

Dallas Swafford
Director of Student Disability Services
Office of Student Affairs
325-942-2047
dallas.swafford@angelo.edu
Houston Harte University Center, Room 112

12.3: Title IX at Angelo State University

The University prohibits discrimination based on sex, which includes pregnancy, sexual orientation, gender identity, and other types of Sexual Misconduct. Sexual Misconduct is a broad term encompassing all forms of gender-based harassment or discrimination including: sexual assault, sex-based discrimination, sexual exploitation, sexual harassment, public indecency, interpersonal violence (domestic violence and/or dating violence), and stalking. As a faculty member, I am a Responsible Employee meaning that I am obligated by law and ASU policy to report any allegations I am notified of to the Office of Title IX Compliance.

Students are encouraged to report any incidents of sexual misconduct directly to ASU’s Office of Title IX Compliance and the Director of Title IX Compliance/Title IX Coordinator at:

Michelle Boone, J.D.
Director of Title IX Compliance/Title IX Coordinator
Mayer Administration Building, Room 210
325-486-6357, michelle.boone@angelo.edu

You may also file a report online 24/7 at www.angelo.edu/incident-form.

If you are wishing to speak to someone about an incident in confidence you may contact the University Health Clinic and Counseling Center at 325-942-2173 or the ASU Crisis Helpline at 325-486-6345.

For more information about resources related to sexual misconduct, Title IX, or Angelo State’s policy please visit: www.angelo.edu/title-ix.

12.4: Observance of Religious Holy Day

A student who intends to observe a religious holy day should make that intention known in writing to the instructor prior to the absence. See ASU Operating Policy 10.19 Student Absence for Observance of Religious Holy Day for more information.

12.5: Incomplete Grade Policy

It is policy that incomplete grades be reserved for student illness or personal misfortune. Please contact faculty if you have serious illness or a personal misfortune that would keep you from completing course work. Documentation may be required. See ASU Operating Policy 10.11 Grading Procedures for more information.
12.6: Required Use of Masks/Facial Coverings

As a member of the Texas Tech University System, Angelo State University has adopted the mandatory Facial Covering Policy\(^8\) to ensure a safe and healthy classroom experience. Current research on the COVID-19 virus suggests there is a significant reduction in the potential for transmission of the virus from person to person by wearing a mask/facial covering that covers the nose and mouth areas. Therefore, in compliance with the university policy students in this class are required to wear a mask/facial covering before, during, and after class. Faculty members may also ask you to display your daily screening badge as a prerequisite to enter the classroom. You are also asked to maintain safe distancing practices to the best of your ability. For the safety of everyone, any student not appropriately wearing a mask/facial covering will be asked to leave the classroom immediately. The student will be responsible to make up any missed class content or work. Continued non-compliance with the Texas Tech University System Policy may result in disciplinary action through the Office of Student Conduct.

12.7: Student Conduct Policies

12.7.1: Academic Integrity

Students are expected to maintain complete honesty and integrity in all work. Any student found guilty of any form of dishonesty in academic work is subject of disciplinary action and possible expulsion from ASU.

12.7.2: Plagiarism

Plagiarism is a serious topic covered in ASU’s Academic Integrity policy\(^9\) in the Student Handbook. Plagiarism is the action or practice of taking someone else’s work, idea, etc., and passing it off as one’s own. Plagiarism is literary theft.

In your discussions and/or your papers, it is unacceptable to copy word-for-word without quotation marks and the source of the quotation. It is expected that you will summarize or paraphrase ideas giving appropriate credit to the source both in the body of your paper and the reference list.

Papers are subject to be evaluated for originality via Turnitin or SafeAssign. Resources to help you understand this policy better are available at the ASU Writing Center\(^10\).

12.7.3: Copyright Policy

Students officially enrolled in this course should make only one printed copy of the given articles and/or chapters. You are expressly prohibited from distributing or reproducing any portion of course readings in printed or electronic form without written permission from the copyright holders or publishers.

13: Course Outline

The course outline is presented in the table next page. Detailed reading and homework assignments along with updates to this schedule will be provided via Bb. The following schedule may be modified as the semester progresses.
<table>
<thead>
<tr>
<th>Week</th>
<th>Lesson</th>
<th>Date</th>
<th>Topic</th>
<th>Reading</th>
<th>Laboratory</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>Jan 25</td>
<td>Introduction to Heat Transfer</td>
<td>1.1</td>
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<tr>
<td>2</td>
<td>27</td>
<td>Feb 1</td>
<td>Introduction to conduction 1</td>
<td>2.1-2.2</td>
<td>Absolut Zero</td>
</tr>
<tr>
<td>3</td>
<td>29</td>
<td>Feb 3</td>
<td>Introduction to conduction 2</td>
<td>2.3-2.4</td>
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<tr>
<td>4</td>
<td>3</td>
<td>Feb 8</td>
<td>1D SS conduction: Plane wall</td>
<td>3.1.1</td>
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<td>5</td>
<td>5</td>
<td>Feb 15</td>
<td>1D SS conduction: Composite wall</td>
<td>3.1.3</td>
<td>Conduction 1</td>
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<td>6</td>
<td>8</td>
<td>Mar 1</td>
<td>1D SS conduction: Radial systems</td>
<td>3.3</td>
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<td>7</td>
<td>10</td>
<td>Mar 8</td>
<td>1D SS conduction: Energy generation</td>
<td>3.5</td>
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<td>8</td>
<td>12</td>
<td>Mar 15</td>
<td>SS 1D conduction extended surfaces 1</td>
<td>3.6</td>
<td>Conduction 2</td>
</tr>
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<td>9</td>
<td>15</td>
<td>Mar 22</td>
<td>SS 1D conduction extended surfaces 2</td>
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<td>17</td>
<td>Mar 29</td>
<td>SS 1D conduction extended surfaces 3</td>
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<td>11</td>
<td>19</td>
<td>Apr 5</td>
<td>Review</td>
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<tr>
<td>12</td>
<td>22</td>
<td>May 2</td>
<td>Exam 1</td>
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<td>May 9</td>
<td>2D steady conduction numerical 1</td>
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<td>2D steady conduction numerical 2</td>
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<td>May 31</td>
<td>Exam 2</td>
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<td>16</td>
<td>31</td>
<td>Jun 7</td>
<td>Review</td>
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<td>17</td>
<td>34</td>
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<td>External convection</td>
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<td>Internal Flow. Energy balance</td>
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<td>Jul 26</td>
<td>Internal flow (laminar, mixed, turbulent)</td>
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<td>Heat exchangers</td>
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<td>25</td>
<td>58</td>
<td>Aug 7</td>
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<td>26</td>
<td>61</td>
<td>Aug 14</td>
<td>Final Project</td>
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</tbody>
</table>

Table 3: Course Lesson Outline
14: End Notes

1 http://www.angelo.edu/student-handbook/
2 http://www.angelo.edu/catalogs/
3 http://www.angelo.edu/services/disability-services/
4 http://www.angelo.edu/incident-form
5 http://www.angelo.edu/title-ix
6 http://www.angelo.edu/content/files/14206-op-1019-student-absence-for-observance-of
7 https://www.angelo.edu/content/files/14197-op-1011-grading-procedures
8 http://www.texastech.edu/downloads/ttus-policy-face-coverings.pdf
9 http://www.angelo.edu/student-handbook/community-policies/academic-integrity.php
10 http://www.angelo.edu/dept/writing_center/academic_honesty.php