ME406-001 Mech Lab-III (2024 Fall) - Dr. Lee
Tue 2:30 pm -5:20 pm (MEC 110)

BASIC INFORMATION

A. Instructor Contact Information with Tas:

Instructor: Prof. Eon Soo Lee (MEC 313, 973-596-3318, eonsoo.lee@njit.edu)

- Office hour: T/W 12:00-1:00pm, or Before or after the class, or by appointments
- online, available by appointments:
  Online Meeting information, informed to class separately.

** Engine Lab Experiment: Mr. David Bailey & Orlando Castillo
(x3320, david.bailey@njit.edu & orlando.castillo@njit.edu)

TA: Yudong Wang (MEC 333-E, yw35@njit.edu).
(Substitute TA: Niladri Talukder, nt22@njit.edu)

B. Course Information and Requirements

1. Course objective: Students can learn how to plan and execute the complex mechanical systems, and understand and apply the background theory of the mechanical systems to evaluate the performance of the mechanical systems.

2. Prerequisite or required knowledge for the class:
   a. ME 405 – Mechanical Laboratory II
   b. ME 407 – Heat Transfer (Conduction and Convection)
   c. ME 311 & 312 – Thermodynamics I & II (Refrigeration and IC Engine)
   d. ME 236 & 237 – Dynamics and Vibration (Vibration) with Strength of Materials

3. Course materials
   a. Mechanical Lab -III Manual. To be posted on Canvas, or ME website.
   b. Supplementary materials by Instructor. To be posted on Canvas.
   c. Auxiliary textbook: *J.P. Holman, Experimental Methods for Engineers, 8th Edition, McGraw-Hill, 2012.*

4. Course Learning Outcomes: Upon completing this course, students will be able to,
   - Demonstrate an ability to conduct experiments in both thermal and mechanical systems
   - Evaluate the performance of complete systems
   - Plan and execute at least one system experiment
   - Prepare effective engineering reports with substantial computer usage and graphical content

5. Student Outcomes: Upon completing this course, students will be able to,
   - Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
   - Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
   - Develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

C. Substitute virtual room (Tuesday 230-5:20 PM) for emergency cases

To be notified by email through Canvas and posted on Canvas Announcement.

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I. SCHEDULE

Wk	Date	Group I	Group II	Group III	Group IV
1	9/3	Course intro: Syllabus, Guidelines, Lab schedule, Grouping, Report guidelines			
		Lecture #1 & 2- Theory & background			
2	9/10	Experiment #1	Experiment #2		
3	9/17	Analysis	Analysis	Experiment #1	Experiment #2
4	9/24	Prelim report	Prelim report	Analysis	Analysis
5	10/1	Lab Report #1(Due) Experiment #2	Lab Report #2(Due) Experiment #1	Prelim report	Prelim report
6	10/8	Analysis	Analysis	Lab Report #1(Due) Experiment #2	Lab Report #2(Due) Experiment #1
7	10/15	Prelim report	Prelim report	Analysis	Analysis
		Lecture #3 & 4- Theory & background			
8	10/22	Lab Report #2(Due) Experiment #3	Lab Report #2(Due) Experiment #4	Prelim report	Prelim report
9	10/29	Analysis	Analysis	Lab Report #2(Due) Experiment #3	Lab Report #1(Due) Experiment #4
10	11/5	Prelim report	Prelim report	Analysis	Analysis
11	11/12	Lab Report #3(Due) Experiment #4	Lab Report #4(Due) Experiment #3	Prelim report	Prelim report
12	11/19	Analysis	Analysis	Lab Report #3(Due) Experiment #4	Lab Report #4(Due) Experiment #3
13	11/26	Thanksgiving	No class		
14	12/3	Prelim report	Prelim report	Analysis	Analysis
15	12/10	Lab Report #4(Due)	Lab Report #3(Due)	Prelim report	Prelim report
	12/17	final exam		Lab Report #4(Due)	Lab Report #3(Due)

Experiments:
1. Engine Lab (Mr. David Bailey)
2. Refrigeration cycle
3. Convection Heat Transfer
4. Vibration Monitoring

II. GRADING

Grading Basis: Total 110

- Grading scale: A (> 90), B (> 80), C (> 70), D (> 60) and F
- Grading Scheme: Total 110%
  - Four experiment reports: 15% each * 4 reports = 60%
  - Final exam: 40%
  - Teamwork, Participation and Attendance: 10% (late/no show/early leave without prior approval, be marked) (SO5)

Experiment Requirements:

- Experiment (#1, 2, 3, 4) attendance is required for the pass.
- Missing of an *experiment class* will go to "20% off" on the report.
- Missing of an *analysis class* will go to "10% off" on the report.
- Missing of *more than two* experiments will go to **"F"** grade.
- Late/No Show/Early Leave without prior approval, to be marked for attendance grading.

Report Guidelines: Writing and Submission

- *Individual report* submission: To be written by your own understanding.
- However, *Group discussion* is strongly encouraged for the analysis of the data.
- No share of the individual report is allowed.
- Plagiarism check: A copied report will be up to 100% off on the grading, depending on the level of copied materials, except the common group data.
- Report contents and format: Please refer to the Lab Report Guidelines in details.
- Report cover page: Please refer to the template of the *report cover page*.

- Report submission: (pdf in Canvas, by 2:30 PM on each due date)
  - Lab Report submission to Canvas: PDF only (+ Plagiarism check)
  - Late submission less than 1 day (24 hrs): 10% off from the grading.
  - Late submission less than 1 week: 30% off from the grading.
  - Late submission more than 1 week: zero point on the report (Not accepted).

Final Exam: (date and time TBD. 5/9/24. 6pm).

- Closed note and materials
- No formula sheet allowed
  - Formula to be provided on the problem sheets

Note:

- Schedules are subject to change, depending on the running of the course during the semester. If there is a change in schedule, it will be announced through Canvas.
- Attendance is important for this lab class.

This course expects students to work without artificial intelligence (AI) assistance in order to better develop their skills in this content area. As such, AI usage is not permitted throughout this course under any circumstance.

III. COURSE WEBSITE

NJIT Canvas

https://njit.instructure.com/courses (UCID login required)
- Be familiar with Canvas!!!
- Check and update your contact email address in Canvas. Everything will be emailed through it.
- Every notice, change and exam information will be posted on Canvas. and sent through it.

IV. ACADEMIC INTEGRITY

NJIT Honor Code is strictly enforced over the course of all the activities including Reports and EXAM.

****** NJIT Honor Code – Strictly Enforced******

http://www5.njit.edu/policies/sites/policies/files/academic-integrity-code.pdf.

"Academic Integrity is the cornerstone of higher education and is central to the ideals of this course and the university. Cheating is strictly prohibited and devalues the degree that you are working on. As a member of the NJIT community, it is your responsibility to protect your educational investment by knowing and following the academic code of integrity policy that is found at:

http://www5.njit.edu/policies/sites/policies/files/academic-integrity-code.pdf.

Please note that it is my professional obligation and responsibility to report any academic misconduct to the Dean of Students Office. ***Any student found in violation of the code by cheating, plagiarizing or using any online software inappropriately will result in disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the university.*** *If you have any questions about the code of Academic Integrity, please contact the Dean of Students Office at dos@njit.edu"*

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SUPPLEMENTARY GUIDELINES

I. GROUP ACTIVITIES

Grouping

- This is an experimental activity-based laboratory course.
- The class will be split into groups with four (4) members as a standard size.
- forming a group is initiated by the instructor as a basis.
- If you want to switch the group number, you can do that on a one-to-one basis as per your preference. If such an event happens, please let me know by email, and get a confirmation and approval from the instructor.

Group roles on your preferences (with a standard size of four (4) members)

- Each member (A, B, C, D) in a group needs to take each leading role as per each experiment (#1, 2, 3, 4).
- Three Major Roles in a Group: Self-assignment by each group members
    - **Group Coordinator**: Build a strong teamwork; Set a frequent group meeting schedule; Open an active group discussion; Arrange a team's easily-accessible virtual space to discuss, Raise productive questions, etc.
    - **Monitor and Calculation**: Monitor the progress of the analysis and calculation of the experiments. Monitor the teamwork for the calculations/sample calculations from the raw data to the post-process, etc.
    - **Recorder and Data management**: Responsible to manage the data; to collect, arrange and distribute the post-processed data and calculations and information. Check if there is any missing calculation, etc.

* 4 Experiments (#1, 2, 3, 4).

Exp#1- Internal Combustion Engine Test
Exp#2- Refrigeration cycle test
Exp#3- Convection HTR experiment
Exp#4- Vibration monitoring

- A - Group Lead
- B/C- Lead in Calculation
- D- Lead in Data management

II. LAB REPORT GUIDELINE

Questions?

Instructor: Dr. Eon Soo Lee
Email: eonsoo.lee@njit.edu

A. GENERAL GUIDELINE

1. Page limit: A report should NOT exceed 20 pages (excluding Appendix)
2. Body text font size: 12 for Times New Roman, 11 for other fonts (except headings or outlines)
3. Spacing: Single spacing between lines
4. Page margins: 1-inch margin (except for figures/tables/plots)

B. GRADING BASIS for Each Report

Grading basis: Long report = < 20 pages (excl. appendix)

- Introduction – 10%
- Theoretical principles – 20%
- Experimental methodology – 10% (SO6)
- Sample analysis – 20% (SO1)
- Results and discussion – 20% (SO5)
- Conclusions – 10% (SO6)
- Cover page + TOC + Abstract + Nomenclature + References (+ Appendix, if any) = 10%

Note: Any lab report not following the guidelines may result in **up to 30% off** in the grading.

C. ITEMS TO INCLUDE ON THE LAB REPORT

1. Cover page (use the cover page word-template posted on Canvas.)
   - Title of the experiment
   - Student's name
   - Group number
   - List names of all team mates and underline the name of the leader
   - Dates on which experiment was performed and it was submitted
   - Instructor's name and course number
   - Teaching assistant's name

2. Table of Contents
   - List contents in sequential order:
     Topic ……..Page #

3. Abstract (around 250 words, recommended) (10 %, including Cover, TOC, Ref, etc)
   - Short description of objectives (What was performed?)

- Short description of Methodology (How was it performed?)
- Short concise summary of Results and discussion with key result data
- Conclusive findings and remarks

4. Introduction (10 %)
   - General introduction of the topic related to the experiment, with representative figures
   - Engineering applications and background: application examples
   - Objectives of the experiment: Short description of methodology of experiment
   - How it is performed, etc

5. Theoretical Principles and Background (20 %)
   - Detailed explanation of the background theory of the experiment, with thermodynamic or theoretical representative figures, including fundamental relations or mathematical backgrounds.
   - Theory behind the experimental method
   - Theory behind data analysis and mathematical relations
   - No sample calculations in this section. Sample calculations in Sample Analysis section.

6. Experimental Methodology (10 %)
   - Experimental system explanation and descriptions
     i. describe it in details;
     ii. create schematic diagram;
     iii. present photos of actual system and explain them;
     iv. description of the operation, etc
   - Major measurement components and/or activities
     i. schematic diagram with photos;
     ii. detailed description of the components:

7. Sample Analysis (20 %)
   - First present a real data set (as a short table) from the experiment for the sample analysis
   - Show step by step details of sample calculations **with detailed explanations.**
   - Symbols or special characters to be explained in details, if used during the analysis.
   - Use actual data (show real data from the experiment in the equations used)
   - You can present figures and/or tables for final analysis results
   - Identify software if used
   - DO NOT only show numbers or calculations, without explanations.

8. Results and Discussion (20 %)
   - Itemized presentation
     i. By Measurement, or by phenomena or by objective
   - Present the full set of the analysis result by tables, plots or figures from the raw data, and provide the detailed explanation of the result data.
     i. First, present the raw data set
     ii. Then, present the result data set, tables, plots, figures, etc

iii. Finally, Provide the Detailed Explanation of the results, tables, figures, result data, etc

- Use figures or tables in discussion
  i. Using figures (preferred)
  ii. Complete data (tables) in Appendix
  iii. Comparison with theory
  iv. Physical interpretation
- Error analysis
  i. Identify sources of errors
  ii. Quantify error margins (if possible)
  iii. Suggestions for improvement (not required)

9. Conclusion (10 %)
   - Major findings and key summary
   - Range of uncertainty of your analysis with experimental data, and/or error margins
   - Conclusive interpretation
   - Your thoughts and conclusive remarks, etc

10. Nomenclature (list of symbols, or special characters used) (counted in Abstract 10%)
    - Alphabetic order
      i. Upper case first, followed by lower case for each symbol
      ii. English, Greek, superscripts, subscripts

11. References (counted in Abstract 10%)
    - Use any standard format
    - https://www.bibguru.com/blog/citation-styles-for-science/
      i. See a book or a scientific journal

    Example:
    - Zhuang, S., **Lee, E.S.**, Nunna, B.B., Lei, L., Kuang, L., Zhang, W. (2016). Synthesis of Nitrogen-Doped Graphene Catalysts by Wet Ball Milling for Electrochemical Systems, International Journal of Energy Research. Volume 40, Issue 15, Pages 2136–2149
    - Zhuang, S., Nunna, B.B., Boscoboinik, J.A., **Lee, E.S.**, (2017). Synthesis of Nitrogen-Doped Graphene Catalysts by Wet Ball Milling for Electrochemical Systems, International Journal of Energy Research, 2017;1–19, https://doi.org/10.1002/er.3821

12. Appendix (Not counted in the page limit)
    - Any Supplementary Figures, Tables, Plots, etc, not included in the main pages.
    - Original raw data sheet (raw data set)
    - Complete set of tables for both raw data and result data, if not included in the result/discussion section.

Final Exam Guideline

1. Exam date and time
   ME406 Final Exam schedule
   TBA-

2. Exam Room: TBA -
To be announced via Canvas and/or emails, after decided by the school office.

3. Topics covered
   Class materials covered in the class and your lab reports:
   - lab manuals, lecture notes, supplementary materials.
   - Internal combustion engine,
   - Vapor Compression Refrigeration Cycle,
   - Heat Transfer (natural and forced convection. condensation)
   - Vibration monitoring

4. Exam requirements
   - Closed book, closed note: No lecture notes or lecture materials allowed.
   - **No Formula sheet allowed.**
     : Formula will be provided on the problem sheets.
   - Calculator only. No other electronics allowed.
   - Pen, erasers allowed.