NAVAL POSTGRADUATE SCHOOL

STUDENT GUIDE

Curriculum 570
Naval-Mechanical Engineering

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Department of
Mechanical & Aerospace Engineering

www.nps.edu/mae

Contents

1. Introduction

This document provides a guide to the resident Mechanical Engineering Degree Programs in the Department of Mechanical & Astronautical Engineering (MAE) Department. Separate guides are available for distance learning programs, the Astronautical Engineering Program, and Doctoral Programs. Much of the information contained within is based on a standard 8-quarter (2 year) 570 curriculum leading to a MSME and the subspecialty code. There are, however, students with programs of different lengths (e.g. 9 quarter, 6 quarter, 4 quarter), and this guide serves these students as well, with the necessary adjustment of the information provided. Regardless of duration, your academic program is tailored to you, and you should consult with the Program Officer and Academic Associate to ensure that your program meets your educational needs, the requirements of your sponsor, and meets degree requirements. This guide provides information on educational objectives, degree requirements, thesis requirements, required paperwork, subspecialty code requirements (for Navy Officers), and planning your educational program. The MAE Department faculty and staff are here to help you succeed.

For questions please see the following people:

CDR Jonathon J. VanSlyke ..... Program Officer (x-2033)
Prof. Joshua H. Gordis ..... Academic Associate (x-2866)
Prof. Knox T. Millsaps ..... Chairman (x-3382)
Prof. Garth Hobson ..... Associate Chairman (x-2888)

Acronyms:

ABET ..... Accreditation Board for Engineering and Technology
BS ..... Bachelor of Science
BSME ..... Bachelor of Science in Mechanical Engineering
ME ..... Mechanical Engineering
MS ..... Master of Science
MSES ..... Master of Science in Engineering Science
MSME ..... Master of Science in Mechanical Engineering
TSSE ..... Total Ship Systems Engineering

2. Welcome Aboard

2.1. Message from the Chairman

Welcome to the Department of Mechanical and Astronuatical Engineering. This guide will help you with planning your academic program at NPS. While the guide is rather complete it is not totally proscriptive, and there can be room in some areas for variations that may better suit your personal educational objectives. So please take the guide in the spirit it was intended - as a guide - and not a complete, regimented set of absolute requirements. If you have questions, come ask us, we are here to support you!

I recommend that you read this document in its entirety so you better understand the complete program, including the requirements and necessary paperwork. This will provide you the opportunity to start exploring your options early, whether it is validating courses you have already taken as an undergraduate, adding special courses you want to take, or starting your thesis research in a given area early.

For most of you this will be your only opportunity at fully funded graduate education, so take full advantage of it. The MAE Department has excellent faculty and experimental and computational research facilities awaiting you. There are student professional organizations, such as ASME, ASNE, and AIAA that can enhance your educational experience and help in your future career. There is the opportunity to obtain a Professional Engineers License while you are here, and there is no better time.

Finally, I welcome you and your family to Monterey. I wish you a memorable and enjoyable experience at NPS. Wherever you go from here, please keep in contact with us so that we may hear from you and share in your successes. Bon Voyage in your academic journey!

Knox T. Millsaps, Ph.D.
Chairman, Deptment of Mechanical & Astronautical Engineering

2.2. Message from the Program Officer

Welcome to the Naval Postgraduate School. On behalf of the Graduate School of Engineering and Applied Sciences (GSEAS) and the entire Mechanical and Astronautical Engineering Department, I would like to take this opportunity to congratulate each and every

one of you on your acceptance and arrival at NPS. I believe that you will find this tour to be intellectually challenging and you will look back on it later in life as one of the most enjoyable tours of your career. I encourage you to seek out a balance of everything that NPS and Monterey have to offer. Maintain focus on your goal of obtaining an advanced degree from one of the finest institutions in the country, but also remember to give your mind a break and work the rest of your body from time to time. Take advantage of the many recreational activities, from kayaking in Monterey Bay to skiing at Lake Tahoe.

We have put together this MAE Department Student Guide with your academic needs in mind. Inside you will find timelines and forms designed to ensure that you are successful in meeting the various academic and administrative requirements for earning a degree. Feel free to consult with the Academic Associate and me for additional guidance as you prepare these forms for submission. Timely submission of these forms is imperative for successfully identifying any additional requirements that you may need to complete your Master's Degree.

Thesis research and presentation of your work to the faculty and your peers is another graduation requirement. You choose the area for thesis research. Do not take this decision lightly. Start your search early by learning about current research that is being conducted in the department by the faculty and other students. You may be able to continue existing research. Perhaps you have knowledge of a fleet problem or a personal interest that you want to explore! Given enough time, it could be developed into an acceptable thesis proposal complete with adequate funding for you to execute.

Please consider the faculty and staff as the most valuable resource in your academic endeavors. We are here to help you succeed. Without you, there is no Naval Postgraduate School and the service that it provides. We will do our part to make your tour successful through a blend of quality education, career guidance and esprit de corps. I look forward to continued interaction with each and every one of you! My door is always open and again, Welcome Aboard!

Jonathon J. VanSlyke
CDR USN
Program Officer, Mechanical Engineering

3. Educational Objectives

The overall educational objective of the Mechanical Engineering program is to support the NPS mission by producing graduates who have knowledge and technical competence, at the advanced level in Mechanical Engineering, to support national security.

In order to achieve this goal, the specific objectives are to produce graduates who have:

- The ability to identify, formulate, and solve technical and engineering problems in Mechanical Engineering and related disciplines using the techniques, skills and tools of modern practice, including modeling and simulation. These problems may include issues of research, design, development, procurement, operation, maintenance or disposal of engineering components and systems for military applications.
- The ability to provide leadership in the specification of military requirements, in the organization and performance of research, design, testing, procurement and operation of technically advanced militarily effective systems. The graduate must be able to interact with personnel from other services, industry, laboratories and academic institutions, and be able to understand the role that engineering and technology have in military operations, and in the broader national and global environment.
- The ability to communicate advanced technical information effectively in both oral and written form.

4. Degree Requirements

4.1 Course Levels and Credit Hours

Each course in the MAE Department falls into one of the following levels:

ME1xxx/**AE1xxx** – Introductory undergraduate-level class
ME2xxx /**AE2xxx** – Undergraduate-level class
ME3xxx /**AE3xxx** – Advanced undergraduate or introductory graduate-level class
ME4xxx /**AE4xxx** – Graduate-level class

The course catalog (either the print version or Python) provides the quarter credit-hours provided by all courses. For example, consider the course, ME2201 Introduction to Fluid Mechanics. This class is assigned a value of (3-2), which means that every week there are 3 hours of lecture, and 2 hours of laboratory. To calculate the quarter credit-hour (QCH) value of a class, apply the following formula:

QCH = Lecture Hours + ½ * Laboratory Hours

For successful completion of ME2201, you will earn 3 + ½ * 2 = 4 QCH. Note that your matrix has four ME0810 classes, which are thesis "slots". These are slots in your matrix which are included as a means of assigning QCH to the thesis (there is no actual lecture or lab meeting). These classes have a value of (0-8) and therefore each ME0810 earns you 4 QCH and hence your thesis earns a total of 16 QCH towards the Master of Science degree.

The following degree requirements are taken from the NPS Academic Catalog.

4.1. Master of Science in Mechanical Engineering (MSME)

- You must have completed work equivalent to the department's requirements for a Bachelor of Science (BS) degree. If you do not have a BS in Mechanical Engineering from an ABET-accredited undergraduate program, you may be able to establish *BSME equivalency,* and hence become eligible to earn the MSME degree. Please refer to **Section 7.3** for discussion of this issue.

- You must earn a minimum of 32 quarter hours of credits in 3000 and 4000 level courses, of which at least 12 credits must be at the 4000 level. Please see **Section 5.2**for information about further requirements for 4000 level courses.

- Of the 32 quarter hours, at least 24 quarter hours must be in courses offered by the Dept. of Mechanical & Astronautical Engineering.

- Of the 32 quarter hours, 8 quarter hours must be taken in technical topics from outside the department, at the 3000 or 4000 level.

- An acceptable thesis for a minimum of 16 credits.

4.2. Master of Science in Engineering Science (Mechanical Engineering -MSES(ME)

- You must have an acceptable academic background.

- You must earn a minimum of 32 quarter hours of credits in 3000 and 4000 level courses, of which at least 12 credits must be at the 4000 level. Please see **Section 5.2** for information about further requirements for 4000 level courses.

- Of the 32 quarter hours, at least 24 quarter hours must be in courses offered by the Mechanical Engineering Department.

- Of the 32 quarter hours, 8 quarter hours must be taken in technical topics from outside the department, at the 3000 or 4000 level.

- An acceptable thesis for a minimum of 16 credits.

- The total quarter credit-hours required is therefore 48 (coursework + thesis).

4.3. Mechanical Engineer

- You must have a superior academic record, including a graduate QPR (3000 and 4000 level classes) of 3.70 or better.

- You may apply to this program after the completion of approximately one year of graduate level study.

- Sixty-four (64) quarter hours of graduate level credits in MAE courses.

- At least 32 of the 64 credit hours must be at the 4000 level.

- In addition, at least 12 credit hours must be earned in technical courses taken outside the department, and at least one advanced mathematics course (4000 level) must be included.

- An acceptable thesis of 28 credits.

- The total quarter credit-hours required is therefore 64 (coursework + thesis).

4.4. Summary of Degree Requirements for Master of Science and Mechanical Engineer Degree

		M.S. ME/AE	Engineer ME/AE
Content	**Level**	**Qtr-Hours (min req'd)**	
MAE	4000	12	32
	3000-4000	12	20
Non-MAE	3000-4000	8	12
Thesis		16	28
Total QTR Hours		**48**	**92**

4.5. Total Ship Systems Engineering (TSSE) Program

The Total Ship Systems Engineering Program is an interdisciplinary, systems engineering and design-oriented program available to students enrolled in Mechanical Engineering programs. TSSE courses are included in the Mechanical Engineering curriculum and count towards MSME degree requirements. The appropriate degree thesis requirements must be met, but theses that address system design issues are welcome. Each of the above degrees requires the TS3001 Fundamental Principles of Naval Architecture (3-2). The TSSE program requires an additional five courses:

TS3000	Electrical Power Engineering (3-2)
TS3003	Naval Combat System Elements (3-2)
TS4001	Integration of Naval Engineering Systems (3-2)
TS4002	Ship Design Integration (2-4)
TS4003	Total Ship Systems Engineering (2-4)

If you decide you would like to add the TSSE track to your matrix, you must add these additional five courses to your matrix. Note that TS4001 and TS4003 can serve as two of the required three 4000-level classes. Therefore, only a net gain of three additional courses required. If you successfully complete the TSSE program, you are eligible to earn the 5602 P-code.

For further information, see Prof. Fotis Papoulias, Director, TSSE Program.

5. Your Thesis

5.1. Overview

This overview will describe the thesis, why it is very important to your graduate study, what are the steps that you will need to do and when they should or must be done, how to find an advisor, and the resources that are available to help you along the way. In the following section, questions and answers are provided for some common questions.

A thesis is a "position or proposition that a person (as a candidate for scholastic honors) advances and offers to maintain by argument." and a document containing results of original research and especially supporting a specific view.

The thesis is the most important part of your graduate education. While the course work lays the foundation by providing analytical methods and tools, it is the thesis that provides you with the opportunity to use this knowledge in a new, original and creative manner. During your thesis research you will be able to consolidate what you have already learned, and possibly extend this by further self-study, and to use this body of knowledge to address a new problem. The thesis will hopefully be your crowning achievement of your graduate study, and will be your introduction to the community of scholars.

The first step in the thesis process is choosing an advisor and a topic. While your formal thesis slots may be in the last 2 or 3 quarters at NPS, it is very important that you have a thesis advisor and topic chosen well before this, preferably a year or so before you plan to graduate. During the time between choosing an advisor/topic and the start of your thesis slots, you should meet regularly with your advisor and spend a few hours a week reading background material and thinking about the problem. Your research can and should in fact begin as soon as possible.

The method for choosing your topic and advisor is completely up to you. However, you are strongly advised to talk to every faculty member in all the areas that you have any interest before making decisions. There are several questions you might want to ask yourself, before

talking to the faculty. What type of work do you most enjoy? Generally, thesis research may be categorized as analytical (e.g. using a pencil and paper for mathematical modeling and derivation of solutions), computational (e.g. using finite element technique or computational fluid mechanics to find solutions, or perhaps writing computer programs yourself), experimental (e.g. designing, building, or modifying an existing set-up to obtain new data) or some combination of the three. It is generally advisable that you take a course from a professor before you make a commitment to work for him or her. The MAE Faculty periodically schedule thesis opportunity presentations, where they will discuss their current research interests and the available topics. In addition, there is a MAE website which contains short written descriptions for current thesis topics of MAE faculty. You may talk to fellow students, who are close to graduating to discuss what they have done and how they enjoyed their experience. However, the faculty member is the best source of information regarding available thesis topics. Finally, you may wish to review previous theses, as well as conference and journal publications from the various faculty members.

Note that your thesis advisor must be a Tenure Track (TT) faculty member from the MAE Dept. Also, in addition to choosing a thesis advisor, you must also identify another faculty member who will serve as a thesis co-advisor, or alternatively, as *second reader*. This person need not be a MAE Dept. TT faculty member. A thesis co-advisor is typically someone who is technically involved with the thesis research and who will also help guide you in your research. A second reader is someone who is not directly involved with your research, but has agreed to read, critique, and edit your thesis.

After you find an advisor and agree on the topic, you are required to fill out a thesis approval form, which must be signed by the thesis advisor, the (570) Academic Associate and the Chairman of the MAE Department.

While your advisor will help you along the way and provide broad guidance and feedback, it is the responsibility of the student to be self-motivated and to initiate all of the steps. Do not expect your advisor to provide a detailed, step-by-step, road map for you. You should develop independence, and think through problems first, before asking your advisor.

However, that does not in any way mean you should avoid meeting with your advisor. You should meet regularly with your advisor to discuss what you have done, what issues have arisen, how you plan to solve them, and what your next steps should be.

One common problem faced by researchers is the failure to sufficiently limit the scope of their work. Being overly broad can lead to a lack of focus and prevent any contribution from being made. It may seem to you that your advisor has asked you to solve a problem that you consider trivial and you may be inclined to broaden the scope. Stay focused on the immediate problem. If you solve the problem then by all mean go on to a larger problem. But initially, keep your focus on a narrow and well-defined problem.

One way that you can help yourself is to write a short Thesis Proposal. It can be useful in helping to consolidate your understanding and focusing your future work. This may be written after you have been working on the problem for several months, have read dozens of articles and it may contain the following elements:

1. Introduction to the problem. This describes the problem and why it is important.
2. State of the art. Literature review and what is not known.
3. Objectives. Your goals for the work. What would be the desired outcome(s)? Be specific. Do not say to better understand something.
4. Proposed work. Very limited and specific.

For you to make an original contribution, it generally requires that you have an understanding of what is already known, by experts in your field. Therefore, one of the primary resources on which you will depend is the NPS library and the reference staff. The library offers a wide variety of seminars on conducting research and completing a thesis. While the world-wide-web is becoming an increasing source of information, and you should make use of it, there are many primary sources, such as books and journals, which are not available on the web. Most of the information on the web is not archival in nature – that is, it might not exist if a certain site is closed. Generally, journal articles are peer-reviewed, and hence provide one of the most reliable and authoritative sources of information. On the other extreme, for example, is Wikipedia, which is not reviewed and may include unreliable

information. One of the most valuable skills you should learn during your thesis is how to obtain and process information and how to synthesize new results from that original information.

After your research is complete you will be required to write and submit a thesis document. For many of you it will be the longest document that you have written. There are several sources available to help you in writing the document, including "How to Write a Thesis" by the MAE Department and several guidelines and templates available on the NPS web site.

Finally you are required to make an oral presentation of your thesis research to the faculty and students of the MAE Department. The presentation is approximately fifteen minutes with about a 5-minute question and answer period. A document on how to prepare and deliver this presentation is available from the Department.

In addition to the forms and the guidelines contained in this document, NPS has extra requirements with regards to thesis processing and other forms to fill out. You will find all of this information in http://web.nps.navy.mil/~code09/research1.html

5.2. Choosing 4000-Level Electives and Thesis Tracks

The requirements for the MS degree include at least three 4000-level classes. These are *electives*, in that you will choose the specific courses you will take. In your matrix, there are "slots" reserved for this, denoted as ME4999. Once you have identified a thesis advisor and topic, your advisor will most likely recommend to you some or all of your electives. These will be chosen to provide you with the advanced knowledge you will need in order to conduct research in your chosen area. Generally, thesis topics will fall into one of the following technical areas, or "tracks":

- Thermal Fluid Sciences
- Shock and Vibrations
- Solid Mechanics
- Dynamic Systems and Control
- System Design
- Materials Science

These tracks are listed in the MSME Checklist (See Appendix 1), which you will fill out prior to graduation. You are required to choose two of your three 4000-level electives from the courses listed in one of the above tracks, and your third elective must be from a different track. This requirement serves to ensure that you will have some depth in a single technical area (two 4xxx courses) while obtaining some breadth by virtue of your third 4xxx course in a different technical area. If you decide to pursue the TSSE program, note that TS4001 and TS4003 can serve as your two electives from within a single track.

6. Timeline for a Two-Year Program

A standard program leading to the MS degree is eight quarters (two years). The following timeline will indicate the approximate times during your program when important actions need to be taken by you. With the exception of the first quarter all other items should be completed by the end of the indicated quarter. If your program is of shorter duration, most if not all of the indicated actions must be taken by you, but at earlier times. We will explain the various actions following the timeline.

Quarter	To Do
1	**Review the course matrix** assigned to you. Compare with the standard matrix (for the appropriate number of quarters to match your program) found in Sections 8.3and 8.4). You may be able to **validate** 2000-level classes and/or **drop** 3000-level classes if you have taken equivalent classes elsewhere (e.g. undergraduate program). Please see Section 8.1 for further information. Fill out your first draft of the **BSME Equivalency** form (Appendix 2) and the **MSME Checklist** (Appendix 1). Bring to Program Officer or Academic Associate for review.
2	
3	Start interviewing the faculty members in order to **identify potential thesis topics**. Make sure you read **Section 5**, Your Thesis, before you do that.
4	**Pick your Thesis Advisor/Topic**. This determines your area of specialization (i.e. "track"). Select and schedule your **electives** (See Section 5.2).
5	If you haven't picked a **Thesis Advisor** already, delay no longer!
6	Fill out (with your Thesis Advisor) and submit (to the Academic Associate) the **Thesis Approval Form** (Appendix 3). Start working on your thesis.

7	Start your **thesis slots** (maybe earlier). Fill out final versions of the **BSME Equivalency Form** (Appendix 2) and **MSME Checklist** (Appendix 1).
8	**Final revisions** (if needed) of the BSME Equivalency and MSME Checklist forms. Fill out the Graduating Student Exit Survey (Appendix 4).
After you graduate	Please keep in touch. Let us know when you reach important milestones in your career, change career paths, etc.

7. If an MS degree requires only 32 course credit-hours, why are there so many courses in my matrix?

The requirements for an MS degree are listed above in Section 4 (and can be found in the NPS Academic Catalog). As you can see, these requirements include eight courses, comprised of three ME3xxx courses, three ME/AE4xxx, and two technical 3xxx/4xxx courses taken outside the department. However, your course matrix, extending over a period of two years, consists of many more courses. Understanding the reasons for the additional courses will help you understand better the impact of changes to your matrix. Keep in mind that your specific educational background and goals will likely require modifications to your assigned matrix, and may in fact require fewer courses (while still meeting the above-stated requirements for the MS degree). Please discuss this with the Program Officer and Academic Associate.

The various courses that you will take serve several purposes. Chief among them are the following:

1. Meet credit-hour requirements for the Master of Science degree (see Section 4)
2. Meet Subspecialty Code 56xxP Engineering Skill Requirements (See Section 7.1)
3. Meet prerequisite requirements for graduate (4000-level) classes also taken as part of your program. See Section 5.2.
4. Provide necessary technical background to support your thesis research.
5. Meet ABET requirements (See Section 7.2).

We have described the credit-hour requirements of the MS degree previously. We will now describe the Educational Skill Requirements and the ABET requirements.

7.1. Educational Skill Requirements (ESRs) and the Subspecialty Codes (P-Codes)

The Educational Skill Requirements (ESR) are a set of technical disciplines in which the program sponsor (NAVSEA) expects students to have gained an understanding. As can be seen from the list provided below, you will have earned the ESR in a particular area by successfully completing those courses in that area. Many of the courses in your matrix serve to establish your ESR and hence your eligibility for the P-Code.

The following is s contained in OPNAV N12:

Officers entering into the Naval/Mechanical Engineering curriculum will be offered the necessary preparatory level courses to enable them to satisfy the equivalent of a baccalaureate degree in Mechanical Engineering. They shall meet, as a minimum, the requirements set forth by the Accreditation Board for Engineering and Technology (ABET). At the graduate level, the officer will acquire the competence to participate in technical aspects of naval systems research, design, development, maintenance and acquisition. The background to deal with future advances is gained through the emphasis on design and a combination of the core program requirements, specialization and thesis research. In pursuit of the above, the goal is for each officer to acquire a senior/upper division-level physical and analytical understanding of the following topics. It is recognized that all students may not meet all ESRs depending on individual circumstances determined by the curricular officer and the academic associate. However, each student will be exposed to fundamentals in all ESR areas.

1. THERMODYNAMICS AND HEAT TRANSFER: Fundamentals of thermodynamics and heat transfer with applications to all marine engineering power cycles as well as propulsion and auxiliary system cycle analysis and design.

ME2101 THERMODYNAMICS (4-1)
ME3150 HEAT TRANSFER (4-1)
ME3240 MARINE POWER AND PROPULSION (4-2)

2. FLUID MECHANICS: Compressible and incompressible flow, both viscous and inviscid, with emphasis on propellers, cavitation, and design of shipboard fluid systems (e.g., fluid machinery, pumps, turbomachinery).

ME2201 INTRODUCTION TO FLUID DYNAMICS (3-2)
ME3201 INTERMEDIATE FLUID DYNAMICS (3-2)

3. DYNAMICS, CONTROL, NAVIGATION, AND AUTONOMOUS SYSTEMS: Kinematics and dynamics of particle, rigid-body and multi-body mechanical systems. Modeling and simulation of engineering systems with mechanical, electrical and hydraulic components. Feedback control concepts, both frequency response and time domain, with applications to the design of component, platform, and weapon systems. Control of systems with continuous, discrete and combined logic states. Navigation and control for single and network-centric systems. Design of intelligent systems for machinery monitoring and automation, as well as autonomous vehicle operations.

ME2502 DYNAMICS (4-1)
ME2801 INTRODUCTION TO ENGINEERING SYSTEM DYNAMICS (3-2)
ME3801 LINEAR AUTOMATIC CONTROLS (3-2)

4. STRUCTURAL MECHANICS AND VIBRATION: Statically determinant and indeterminate structural analysis, stress/strain analysis, buckling and fatigue. Shock and vibration response of marine structures, including surface ships and submarines.

ME2501 STATICS (3-0)

ME2601 SOLID MECHANICS I (3-2)
ME3521 MECHANICAL VIBRATIONS (3-2)
ME3611 SOLID MECHANICS II (4-0)

5. MATERIALS AND FABRICATION: Metallurgical processes and transformations; analytical approach to failure of materials in Naval Engineering use and a basic understanding of the materials technology associated with welding and marine corrosion; an introduction to the developing fields of composites and superconducting materials.
MS2201 ENGINEERING MATERIALS (3-2)
MS3202 FAILURE ANALYSIS AND PREVENTION (3-2)
MS3304 CORROSION AND MARINE ENV. DEGRADATION (3-2)
MS3606 INTRODUCTION TO WELDING & JOINING METALLURGY (3-2)

6. COMPUTERS: A basic understanding of computer system architecture, operating systems (such as UNIX), networking and introduction to engineering software design. Practical experience of structured programming languages (such as FORTRAN, C), and the use of integrated design tools for computational and symbolic manipulation (such as MATLAB and Maple). Use and application of mainframe, workstation and personal computers for the solution of Naval engineering design and analysis tasks. Exposure to finite element and finite difference tools and techniques, with application to the thermo-fluid and structural mechanics/dynamics areas, including experience of representative software packages.
EC1010 MATLAB (1-1)
ME3450 COMPUTATIONAL METHODS IN MECH. ENG. (3-2)
MA3232 NUMERICAL METHODS FOR PDE (3-2)

7. MATHEMATICS: Sufficient mathematics, including integral transforms and numerical analysis, to achieve the desired graduate education.
MA1115 MULTI-VARIABLE CALCULUS (4-0)
MA1116 VECTOR CALCULUS (4-0)
MA2043 INTRODUCTION to LINEAR AND MATRIX ALGEBRA (4-0)
MA2121 DIFFERENTIAL EQUATIONS (4-0)
MA3132 PARTIAL DIFFERENTIAL EQUATIONS (4-0)
MA3232 NUMERICAL METHODS FOR PDE (3-2)
OS3104 STATISTICS FOR SCIENCE AND ENGINEERING (4-0)

8. DESIGN/SYNTHESIS: Design synthesis and introduction to optimization techniques, with emphasis on the design of mechanical subsystems and their integration into the ship system.
ME3711 DESIGN OF MACHINE ELEMENTS (4-1)
ME3712 CAPSTONE DESIGN PROJECT (1-6)

9. ELECTRICAL ENGINEERING: Electromagnetic and circuit theories, dc circuits, steady-state ac circuits, methods of circuit analysis, including Laplace transforms. Exposure to the construction and operating characteristics of rotating machinery, static converters, and power distribution systems and multiphased circuits.
EO2102 INTRODUCTION TO CIRCUIT AND POWER SYSTEM ANALYSIS (4-2)

10. NAVAL ARCHITECTURE: Fundamentals of naval architecture including the geometry, hydrostatics and hydrodynamics of monohull floating and submerged structures. Wave and skin friction analysis, power requirements of particular designs. Longitudinal and transverse stability of floating and submerged bodies, hull girder strength requirements. Introduction to seakeeping and survivability principles.
TS3001 FUNDAMENTAL PRINCIPLES IN NAVAL ARCHITECTURE (3-2)

11. SPECIALIZATION: Each officer will also acquire technical competence in one or more of the following areas: THERMAL/FLUID SCIENCES, SOLID AND STRUCTURAL MECHANICS, DYNAMICS AND CONTROLS, MATERIAL SCIENCE, OR TOTAL SHIP SYSTEMS ENGINEERING through additional graduate level courses and their associated prerequisites.
Three (3) ME4XXX COURSES (minimum of 12 quarter hours)

12. JOINT AND MARITIME STRATEGIC PLANNING: American and world military history and joint and maritime planning including the origins and evolution of national and allied strategy; current American and allied military strategies which address the entire spectrum of conflict; the U.S. maritime component of national military strategy; the organizational structure of the U.S. defense establishment; the role of the commanders of unified and specified commands in strategic planning, the process of strategic planning; joint and service doctrine, and the roles and missions of each in meeting national strategy.
NW3230 STRATEGY AND POLICY: THE AMERICAN EXPERIENCE (4-2)

13. THESIS: The graduate will demonstrate the ability to conduct independent analysis, in the area of Naval/Mechanical Engineering and proficiency in presenting the results in writing and orally by means of a thesis and command-oriented briefing appropriate to this curriculum.
Four (4) ME0810 Thesis slots (equivalent of 16 quarter hours)

Some of these ESRs may be satisfied by your undergraduate education, such as if your undergraduate degree is a BSME. It is possible to validate or drop classes that appear on this list, such as if you have taken a similar class elsewhere. However, you should check with the Program Officer to make sure you understand the impact on your associated ESR's and the P-code. Please refer to Section 8 on Making Changes to Your Course Matrix. If you successfully complete the TSSE program, you are eligible to earn the 5602 P-code.

7.2. ABET Requirements

ABET is the Accreditation Board for Engineering and Technology. What is accreditation? From the ABET website:

> "In the United States, accreditation is a non-governmental, peer-review process that assures the quality of the postsecondary education students receive. Educational institutions or programs volunteer to undergo this review periodically to determine if certain criteria are being met."

What is ABET accreditation? Again, from the ABET website:

> "ABET accreditation is assurance that a college or university program meets the quality standards established by the profession for which it prepares its students. For example, an accredited engineering program must meet the quality standards set by the engineering profession. An accredited computer science program must meet the quality standards set by the computing profession."

The NPS Mechanical Engineering program is ABET-accredited at the Master's level, and The MSME degree (See Section 4.1) awarded reflects this accreditation. The MSES degree (Section 4.2) is not ABET-accredited, but is equivalent in all other respects.

In order to confer an ABET-accredited MSME degree, you must have an earned BSME degree from an ABET-accredited undergraduate program, or demonstrate that you have accumulated the equivalent education. This is explained in the following section.

7.3. BSME Equivalency

In order for you to be eligible to earn the MSME degree, you must:

1. Have a BSME degree from an ABET-accredited undergraduate program, *or*,
2. Demonstrate BSME equivalency by filling out the BSME Equivalency Checklist (included in the Appendices).

The BSME Equivalency Checklist is an accounting of all undergraduate-level courses you have taken that are equivalent to courses you would have taken in an accredited BSME program. You will fill out this list with all eligible courses from your prior schooling, and from NPS. You will then establish whether your various credit-hour totals meet or exceed the requirements, as indicated on the Checklist. If all of the requirements are met, this Checklist then serves to document that you have had the equivalent undergraduate education to that of an ABET accredited BSME program, and you are then eligible to earn the MSME. If you cannot satisfy all of the requirements on the Checklist, you are therefore not eligible to earn the MSME, and can earn the MSES.

The course accounting required by the Checklist includes courses in mathematics, up through linear algebra and differential equations, courses in science including college-level chemistry and calculus-based physics, humanities and liberal arts courses, as well as mechanical engineering, and other (non-mechanical) engineering courses. You may populate this list with courses you have taken at other colleges and universities as well as with courses you have taken here at NPS. Since your NPS Master's degree requires only 32 credit-hours, you will find that many of the courses in your matrix can be used to populate the list and contribute to you establishing BSME equivalency. In other words, once you have set aside the required 3000-level and 4000-level classes in your matrix to count toward MS credit-hour requirements, some of the remaining courses in your matrix can be used to populate the BSME Checklist. It is important to keep in mind that if a

course is used to establish BSME equivalency (i.e. is included on the Checklist) it *cannot* be counted towards credit-hour requirements for the MS degree.

8. Your Course Matrix

You are assigned a course matrix when you arrive at NPS. This matrix is generic, and is intended to be modified by you with the advice and consent of the Program Officer and Academic Associate. In order to ensure proper scheduling, it is highly recommended having your matrix updated in Python by the end of the second week of your first quarter. Even though the matrix has been generated in Python, it is the student's responsibility to ensure that it meets the requirements for graduation and ESRs. Also, ensure courses selected are in the correct quarter by verifying course offerings with the NPS Academic Catalog. Generic 8-quarter and 9-quarter course matrices are shown in Sections 8.3 and 8.4 respectively.

Looking at your matrix, you will notice that each quarter will have at least four courses, and several quarters may have more than four. You are required to carry a minimum of four courses per quarter (a "full load"). You will also see that there are "courses" that reappear every quarter, such as ME0951 Mechanical Engineering Seminar. This course is used for the department to bring in speakers from the military, industry, and academia to provide information on topics of current interest. Attendance by all students is mandatory, unless specially excused. Therefore, ME0951 must appear in your matrix every quarter.

All changes to your program are subject to final approval or disapproval by the department Chair. There are various modifications you might make to your matrix and also various reasons why you might do so. Modifications can include moving a class to a different quarter, adding a course, or dropping or validating a course. As we discussed in Section 7, the various courses which appear in your matrix in general serve a variety of purposes. So it is important that you discuss any proposed change with the Program Officer and Academic Associate.

A good thing to keep in mind is that you are attending a graduate school, with the opportunity to gain advanced knowledge in engineering. This advanced knowledge is primarily contained in the 4000-level classes. You are required to take three 4000-level classes in order to earn a MS degree. However, if possible, it is to your advantage to evaluate your matrix to see if you can

take more than three. This will benefit you greatly, not only in doing your thesis research, but in the additional advanced knowledge you will gain.

One possible opportunity gained from validating and dropping courses is to make room in your matrix to earn the Mechanical Engineer's (ME) Degree. This degree involves substantially more coursework than the MS degree, and a more substantial thesis. The MS thesis earns 16 credits, while the ME degree earns 28 credits. This degree can be seen as being a great opportunity to take more advanced courses, do more research, and perhaps earn credit hours towards a Ph.D.

We will now discuss how you might remove courses you have already taken, at another college or university, from your matrix.

8.1. Validating 2000-Level Courses

You will see that there are a variety of 2000-level classes in your matrix. Validating a class is a means of documenting that you have already successfully taken this class elsewhere, and also receiving the permission to drop the class. You may have had one of more of these classes previously, such as in an undergraduate engineering program. For example, you might have taken a course in Thermodynamics at a previous college or university, if you were a Mechanical Engineering student, or a Chemical Engineering student. If you received a grade of C or better, you should consider validating this class. By validating a class, and hence dropping it from your matrix, you make room to move another class “up” (i.e. take it earlier in your matrix) and hence make room for additional 4000-level classes. Keep in mind that while you may have had a course previously, if it has been a long time since you took the course, you may benefit from taking it again at NPS. This is a judgment you must make; please consult with the Program Officer and Academic Associate for guidance.

The only classes that require validation in order to drop them are 2000-level classes. 3000-level classes and above can be dropped by making a drop request in Python. The drop requires the approval of both the Program Officer and Academic Associate. See Section 8.2.

The steps you must take to **validate a course** are:

1. Put in a Validation request into Python (see the Ed-Tech).

2. Make an appointment with the Course Coordinator for the course, to discuss validation. Bring your transcript from the school where you took the course previously, the syllabus, and the text book (if you have it).
3. The Course Coordinator will ask you questions about the course material, and may ask you to take a test to evaluate your knowledge.
4. The Course Coordinator may then approve the validation. The approved validation request will then go the Program Officer and Academic Associate for their approval. Once approved, the class may be dropped.

8.2. Dropping 3000- and 4000-Level Courses

You may find that you have a 3000-level course in your matrix which you may have taken already at a previous school, or you may have limited time at NPS and you need to take another course and can't fit both courses in. You may request, through Python, to drop this course. The Program Officer and Academic Associate may approve this drop; however you must provide a justification for dropping this course. Keep in mind the potential impact of dropping a course on meeting the requirements for:

- Earning the MS degree (credit-hours) (See Section 4)
- Earning your ESR (Section 2)
- Meeting ABET requirements (Section 7.2)
- Prerequisites for follow-on courses (e.g. 4000-level classes)
- Maintaining a full course load each quarter

8.3. *Generic 8 Quarter Mechanical Engineering Matrix With (Sched) and (Pre-Reqs)*

QTR					
1	MA1115 ***(1,2,3,4)*** Multi-Variable Calculus (4-0) ***(MA113-4/EQ)***	MA1116 ***(1,2,3,4)*** Vector Calculus (3-0) ***(MA113-4/EQ)***	ME2101 *(1,3)* Thermodynamics (4-2) *(MA1115)*	ME2502 *(1,3)* Engineering Dynamics (5-0) *(MA1115-C)*	NW3230 ***(1,2,3,4)*** Maritime and Joint Strategic Planning (4-0) ***(-)***
2	MA 2121 ***(1,2,3,4)*** Diff Eqns (4-0) ***(MA1115-6)***	MA2043 ***(1,2,3,4)*** Linear Algebra (4-0) ***(-)***	ME2601 *(2,4)* Mechanics of Solids I (4-1) *(ME2501/MA115)*	MS2201 *(2,4)* Materials Science (3-2) *(-)*	OS3104 ***(2)*** Probs & Stats for Engineers (4-0) ***(-)***
3	MA3132 ***(1,2,3,4)*** Partial Differential Equations (4-0) ***(MA2121/MA1116)***	MA3232 ***(1,2,3,4)*** Numerical Analysis (4-0) ***(MA2121/MA2043)***	ME3611 *(1,3)* Mechanics of Solids II (4-0) *(ME2601)*	ME2201 *(1,3)* Fluid Mechanics I (3-2) *(ME2503)*	NW3275 (1,2,3,4) Joint Maritime Operations - part 1 (4-0) ***(-)***
4	EO2102 ***(2,4)*** Intro to Circuit & Power Systems Analysis (4-2) ***(-)***	ME3521 *(2,4)* Mechanical Vibrations (3-2) *(ME2503/ME2601/MA2139)*	ME3201 *(2,4)* Applied Fluid Mechanics (4-1) *(ME2101/ME2201/MA3132)*	ME3150 *(2,4)* Heat Transfer (4-1) *(ME2101/ME2201/MA3132-C)*	NW3276 ***(1,2,3,4)*** Joint Maritime Operations - part 2 (2-2) ***(-)***
5	ME2801 *(1,3)* System Dynamics (3-2) *(ME2503/MA2139)*	MS3202 (1,3) Failure Analysis and Prevention (3-2) *(MS2201)*	ME3711 *(1,3)* Machine Design (4-1) *(ME2601)*	ME3450 *(1,3)* Computational Methods in Mech Engineering (3-2) *(EC1010/MA3232/ME3150/ME3201/ME3611)*	NW3285 ***(1,2,3,4)*** National Security Decision Making (4-0) ***(-)***
6	ME3801 *(2,4)* Automatic Controls (3-2) *(ME2801)*	ME3240 *(2,4)* Marine Power and Propulsion (4-2) (ME2101, ME2201)	ME3712 *(2,4)* Systems Design (4-2) *(ME3711)*	ME4999 Specialization Elective	
7	ME0810 Thesis	ME0810 Thesis	ME4999 Specialization Elective	MS3304 Corrosion *(3)* (3-2) *(MS2201)* - OR - MS3606 Welding *(1)* (3-2) *(MS2201/MS3202)*	
8	ME0810 Thesis	ME0810 Thesis	ME4999 Specialization Elective	TS3001 *(2,4)* Naval Architecture (3-2) *(ME2201/ME2601)*	

8.4. *Generic 9 Quarter Mechanical Engineering Matrix With (Sched) and (Pre-Reqs)*

QTR					
1	MA1113 ***(1,2,3,4)*** Single Variable Calculus I (4-0) ***(MA113-4/EQ)***	MA1114 ***(1,2,3,4)*** Single Variable Calculus I w Matrix Algebra (4-0) ***(MA113)***	ME2501 *(1,3)* Engineering Statics (5-0) ***(MA1115-C)***	EC1010 *(1,3)* Introduction to MATLAB (1-1) ***(-)***	
2	MA1115 ***(1,2,3,4)*** Multi-Variable Calculus (4-0) ***(MA113-4/EQ)***	MA1116 ***(1,2,3,4)*** Vector Calculus (3-0) ***(MA113-4/EQ)***	ME2101 ***(1,3)*** Thermodynamics (4-2) ***(MA1115)***	ME2502 *(1,3)* Engineering Dynamics (5-0) ***(MA1115-C)***	NW3230 ***(1,2,3,4)*** Maritime and Joint Strategic Planning (4-0) ***(-)***
3	MA 2121 ***(1,2,3,4)*** Diff Eqns (4-0) ***(MA1115-6)***	MA2043 ***(1,2,3,4)*** Linear Algebra (4-0) ***(-)***	ME2601 ***(2,4)*** Mechanics of Solids I (4-1) ***(ME2503/MA115)***	MS2201 ***(2,4)*** Materials Science (3-2) ***(-)***	OS3104 ***(2)*** Probs & Stats for Engineers (4-0) ***(-)***
4	MA3132 ***(1,2,3,4)*** Partial Differential Equations (4-0) ***(MA2121/MA1116)***	MA3232 ***(1,2,3,4)*** Numerical Analysis (4-0) ***(MA2121/MA2043)***	ME3611 ***(1,3)*** Mechanics of Solids II (4-0) ***(ME2601)***	ME2201 ***(1,3)*** Fluid Mechanics I (3-2) ***(ME2503)***	NW3275 (1,2,3,4) Joint Maritime Operations - part 1 (4-0) ***(-)***
5	EO2102 ***(2,4)*** Intro to Circuit & Power Systems Analysis (4-2) ***(-)***	ME3521 ***(2,4)*** Mechanical Vibrations (3-2) ***(ME2503/ME2601/MA2139)***	ME3201 ***(2,4)*** Applied Fluid Mechanics (4-1) ***(ME2101/ME2201/MA3132)***	ME3150 ***(2,4)*** Heat Transfer (4-1) ***(ME2101/ME2201/MA3132-C)***	NW3276 ***(1,2,3,4)*** Joint Maritime Operations - part 2 (2-2) ***(-)***
6	ME2801 ***(1,3)*** System Dynamics (3-2) ***(ME2503/MA2139)***	MS3202 (1,3) Failure Analysis and Prevention (3-2) ***(MS2201)***	ME3711 ***(1,3)*** Machine Design (4-1) ***(ME2601)***	ME3450 ***(1,3)*** Computational Methods in Mech Engineering (3-2) ***(EC1010/MA3232/ME3150/ ME3201/ME3611)***	NW3285 ***(1,2,3,4)*** National Security Decision Making (4-0) ***(-)***
7	ME3801 ***(2,4)*** Automatic Controls (3-2) ***(ME2801)***	ME3240 ***(2,4)*** Marine Power and Propulsion (4-2) (ME2101, ME2201)	ME3712 ***(2,4)*** Capstone Design Project (4-2) ***(ME3711)***	ME4XXX Specialization Elective	
8	ME0810 Thesis	ME0810 Thesis	ME4XXX Specialization Elective	MS3304 Corrosion ***(3)*** (3-2) ***(MS2201)*** - OR - MS3606 Welding ***(1)*** (3-2) ***(MS2201/MS3202)***	
9	ME0810 Thesis	ME0810 Thesis	ME4XXX Specialization Elective	TS3001 ***(2,4)*** Naval Architecture (3-2) ***(ME2201/ME2601)***	

8.5. Review Your Matrix

When you arrive at NPS and are assigned a matrix, there are several important issues to carefully review. We will describe the various courses in your matrix, and the purposes they serve. Those courses that you might be able to validate or drop (in order to add additional 4000-level classes) will be identified.

ME2xxx - Undergraduate-level Mechanical Engineering (ME): These courses are provided for those students who do not have ME degrees, or who have been out of school for a long time and need a refresher. The credit earned by these courses cannot be used to satisfy MS degree requirements, but can be used to establish BSME equivalency (See Section 7.3). These courses are typically prerequisites for the ME3xxx classes. These classes are also part of ESR requirements and hence contribute to you earning the P-Code (see Section 7.1).

You should consider **validating** (see Section 8.1) as many of the 2000-level classes as possible. If you have taken these classes previously, you might be able to validate these classes, creating more room in your matrix for additional 4000-level classes, or perhaps adding an additional program such as the TSSE program (See Section 4.4), which requires five additional classes.

MA1xxx-MA3xxx –Undergraduate through Graduate-level Math: These classes provide you with necessary mathematics for the engineering classes. Several engineering classes explicitly require one of these math classes as a prerequisite. ABET requires that all students receiving the MSME degree to have taken a linear algebra class, i.e. linear algebra is a specific ABET requirement for eligibility for the MSME degree. You may be able to validate some (or all) of the MA1xxx-2xxx classes, including **MA2043**, if you have taken them elsewhere. If you have not taken a linear algebra class elsewhere, and you intend to earn the MSME degree, you must take this class. You can discuss validation with the Course Coordinator for the specific math class, and this faculty member can be found in the Math Dept. Many of these math classes are ESR requirements, and hence contribute to you earning the P-Code (see Section 7.1). The course, **OS3104** Probability and Statistics for Engineers, is also a specific ABET requirement for eligibility for the MSME degree. If you have taken a similar course elsewhere, you may drop this course (Section 8.2), with approval of the Program Officer and Academic Associate.

ME3xxx - Advanced undergraduate or introductory graduate-level ME: These classes constitute the core of the Mechanical Engineering program. They contribute to the credit-hour requirements for the ME degree, are ESR requirements (contribute to you earning the P-Code, see Section 7.1), and individually, may be prerequisite for other classes, such as graduate-level (4xxx) Mechanical and Astronautical Engineering classes. If you have taken one or more of these classes elsewhere, you may be able to drop them, with approval of the Program Officer and Academic Associate. Discuss this with the Program Officer and the Academic Associate.

ME4xxx - Graduate-Level ME: These classes are chosen by you. Specific ME4xxx classes are frequently required by your Thesis Advisor, as they will provide you with the advanced knowledge required for you to perform the research. At least three 4xxx classes are required for the MS degree. Please see Section 5.2 for specific requirements for graduate electives. Note that the ESR (Section 7.1) requires each Officer to obtain technical specialization by taking electives from within a single "track" (See Section 5.2).

ME0810 ME Thesis: These four slots provide you with 16 credit-hours for your thesis. You may have no more than two thesis slots in a single quarter, and you are limited to four slots total for the MS degree.

EC1010 Introduction to Matlab: Due to the widespread use of Matlab in coursework and thesis research, this course is provided as an introduction to the use of Matlab. If you feel you don't need this course, due to prior experience with Matlab, or confidence in your ability to learn it on your own, you may drop this class, with approval of the Program Officer and Academic Associate.

EO2102 Intro to Circuit & Power Systems Analysis: This course is provided to meet an ESR. If you have taken a basic circuits class elsewhere, you may drop this course, with approval of the Program Officer and Academic Associate. Note that TS3000 can be used to satisfy this ESR.

NW3xxx – Naval War College JPME: If you are a URL Officer, you will have the four Naval War College (NW) courses in your matrix. If you are an EDO, you will have only NW3230. These courses are offered every quarter, so moving them to different quarters, if necessary, is possible.

9. Filling Out the BSME Equivalency Form and the MSME Checklist

As discussed in previous section (Section 7.3), every student must fill out the BSME Equivalency form prior to graduation. Additionally, every student must also fill out the MSME Checklist. The MSME Checklist documents all of the classes you have taken which contribute to the credit-hours required for the MS degree. All students, regardless of the specific degree they are earning (MSME or MSES) must fill out this form.

9.1. When to Fill Out These Forms

These forms are reviewed and signed by the Program Officer, Academic Associate, and the Chairman prior to your graduation. Therefore, final versions of these forms must be in your folder (stored by the Ed. Tech) at this time. As you progress through your program, your course matrix will undoubtedly change, such as when you select your specific 4000-level classes. You should keep these forms up to date as you progress through the program, so that at graduation time, the forms are accurate and complete. Nobody wants to find themselves without sufficient credit-hours in their last quarter, thereby jeopardizing their degree eligibility. Note that if you have a BSME degree from an ABET-accredited program, you can fill out and sign the BSME Equivalency form in your first quarter. The form can then be reviewed and signed by the Program Officer and Academic Associate.

9.2. How to Fill Out These Forms

You should first fill out the MSME Checklist. This form asks you to list all of the courses that will count towards the required credit-hours for the MS degree. In short, this form requires 3 ME3xxx course, 3 ME/AE4xxx courses, and two technical 3000 or 4000-level classes from outside the MAE department (most students use MA3132 and MA3232 for this purpose, which are included in your matrix by default). Once a class is listed on your MSME Checklist, you may not list them on your BSME Equivalency form. Your remaining classes (classes not listed on the MSME Checklist) are available to be included on your BSME Equivalency form if you do not have BSME degree from an ABET-accredited program.

If you have a BSME degree from an ABET-accredited program, filling out the BSME form is still required, but involves only completing the first page. If not, you must completely and accurately fill out the entire form. You will most likely need your undergraduate transcript in order to do this. Please see the Program Officer and Academic Associate for guidance.

10. Graduating Student Exit Survey

This is very important, please fill out this form and submit it to the chairman when you graduate.

11. APPENDICES

Appendix 1 -MSME Checklist

Appendix 2 - BSME Equivalency form

Appendix 3 - Thesis Approval Form

Department of Mechanical Engineering
Checklist for MSME Degree

The Department of Mechanical Engineering at the Naval Postgraduate School is accredited at the Master of Science degree level through the Accreditation Board of Engineering and Technology and the Western Association of Schools and Colleges. Those accreditations are based on degree requirements set forth by the Mechanical Engineering Department at NPS and approved by the NPS Academic Council. This checklist is provided to document the completion of those degree requirements.

Student Name:
E-mail Address:
Month/year Enrolled:
Month/year of Graduation:

I certify that the information on this form is correct.

Student Signature: _____

We certify that this student has met the minimum requirements for the MSME degree.

_____ _____

MAE Program Officer, Date **MAE Academic Associate, Date**

_____

MAE Department Chair, Date

Last Updated: April 3, 2003

1. **BSME Degree / Equivalence Requirement** satisfied by (fill in one):

BSME degree from: Month/Year

BSME Equivalence from NPS. Date (from completed checklist)

2. **Thesis Requirement:**

Number of Thesis Credits (16 minimum)

Thesis Advisor:

Thesis Title:

3. **Competancy / Track Requirement:**

In completion of the requirements for a Master of Science Degree in Mechanical Engineering, a specific Specialization Track within the discipline of Mechanical Engineering must be delcared. Identify the specialization track completed below:

☐ **Thermal Fluid Sciences** Must Complete Minimum of Two Courses Listed Below		
Course Number	**Course Title**	**Taken**
ME4160	Applications of Heat Transfer	
ME4161	Conduction of Heat Transfer	
ME4162	Convection of Heat Transfer	
ME4163	Radiation Heat Transfer	
ME4202	Compressible Flow	
ME4211	Applied Hydrodynamics	
ME4220	Viscous Flow	
ME4240	Advanced Topics in Fluid Dynamics	

☐ **Shock and Vibrations** Must Complete Minimum of Two Courses Listed Below		
Course Number	**Course Title**	**Taken**
ME4522	Finite Element Methods in Structural Dymanics	
ME4525	Naval Ship Shock Design and Analysis	
ME4731	Engineering Design Optimization	
ME4550	Random Vibrations	

☐ **Solid Mechanics** Must Complete Minimum of Two Courses Listed Below		
Course Number	**Course Title**	**Taken**
ME4612	Advanced Mechanics of Solids	
ME4613	Finite Element Methods	
ME4620	Theory of Continuous Media	

☐ **Dynamic Systems and Control** Must Complete Minimum of Two Courses Listed Below

Course Number	**Course Title**	**Taken**
ME4731	Engineering Design Optimizatio	

	n	
ME4811	Multivariable Control of Ship Systems	
ME4812	Fluid Power Control	
ME4821	Advanced Dy	

	namics	
ME4823	Dynamics of Marine Vehicles	
ME4825	Marine Propulsion Control	

☐ **System Design** Must Complete Minimum of Two Courses Listed Below		
Course Number	**Course Title**	**Taken**
TS4001	Integration of Naval Engineering Systems	
TS4003	Ship Design Integration	
ME4731	Engineering Design Optimization	

☐ **Materials Science** Must Complete Minimum of Two Courses Listed Below		
Course Number	**Course Title**	**Taken**
MS4215	Phase Transformation	
MS4312	Characterization of Advanced Materials	
MS4811	Mechanical Behavior of Engineering Materials	
ME4613	Finite Element Methods	
MS4822	Engineering and Science of Composite Materials	

☐ **Exception Track** Must Include a Minimum of Two Courses in a Specialization Track Approved by both the Department Chairman and Academic Associate		
Course Number	**Course Title**	**Taken**

4. Course Credit Requirements:

The Master of Science degree in Mechanical Engineering requires at least 32-quarter hours of graduate level credits. At least 12-quarter hours must be at the 4000 level and at least 24 quarter hours must be in courses offered by the Mechanical Engineering Department. Identify courses to be counted toward the MSME degree:

NOTE: NO COURSES COUNTED TOWARD A BSME EQUIVALENCY MAY BE COUNTED TOWARD MSME GRADUATION REQUIREMENTS

A. List 4000 Level Courses applied toward MSME degree.

Course Number	**Course Title**	**Quarter Hours**
Total 4000 Level Hours		**(12 required)**

B. List All 3000 and 4000 Mechanical Courses applied toward MSME. Include duplicates of Mechanical Engineering Courses listed above.

Course Number	**Course Title**	**Quarter Hours**
Total Mechanical Engineering 3000 and 4000 level courses		**(24 required)**

C. List all 3000 and 4000 level courses applied toward MSME degree (Mechanical Engineering non-Mechanical Engineering graduate level courses):

Course Number	**Course Title**	**Quarter Hours**
Total ALL MSME degree 3000 and 4000 level courses		**(32 required)**

Department of Mechanical Engineering
Checklist for BSME Degree Equivalence

The Department of Mechanical Engineering at the Naval Postgraduate School is accredited at the Master of Science degree level through the Accreditation Board of Engineering and Technology. Students earning a Master of Science in Mechanical Engineering or a Degree of Mechanical Engineer at NPS, must either have attained an ABET accredited undergraduate Mechanical Engineering degree, or earned the equivalency of a Bachelor of Science Degree in Mechanical Engineering. Some courses from the student's undergraduate institution may count toward that equivalency, even though his final undergraduate may not have been in Mechanical Engineering. Some courses taken at NPS may also be applied to meeting this undergraduate equivalency. This checklist is provided to document the completion of that equivalency.

Student Name:
E-mail Address:
Month/year Enrolled:
Month/year of Graduation:

I certify that the information on this form is correct.

Student Signature: _____

Undergraduate Institutions Attended:

INSTITUTION	DATE		DEGREE EARNED
	From	**To**	
	From	**To**	
	From	**To**	

Do you already have an ABET accredited BSME degree? Check one response only.

☐ **YES - Skip the rest of this form. Go directly to the MSME Checklist form.**
☐ **NO - Complete the rest of this form. Then proceed to the MSME Checklist.**

We certify that this student has met the minimum requirements for the equivalency of the BSME degree.

_____ _____

ME Program Officer, Date **ME Academic Associate, Date**

_____

ME Department Chair, Date

Last Updated: April 5, 2003

I. Mathematics

A. A minimum of 24 quarter credit hours or 16 semester credit hours of college-level mathematics is required. List all college-level mathematics courses passed with a grade of C or better. For each course, indicate the college or university where the course was taken, the course number, the course title, and the number of credit hours.

University	**Course Number**	**Title**	**Quarter Credit Hours**	**Semester Credit Hours**
		Quarter Credit Hours Sub Total		
		Semester Credit Hours Sub Total		

Total Math Credits (Qtr Credits + (1.5 × Sem Credits)): **(24 required)**

B. For each of the following mathematics subjects that has been studied, indicate the college or university where the subject was studied, the course number, and the course title. All courses must have been passed with a grade of C or better.

Subject	University	Course Number	Course Title
Multivariable Calculus			
Differential Equations			
Linear Algebra			
Statistics			

II. Sciences

A. Basic Science

A minimum of 24 quarter credit hours or 16 semester credit hours of college-level basic science is required. Studies must inlcude both general chemistry and calculus based physics. List all college-level basic science courses passed with a grade of C or better. For each course, indicate the college or university where the course was taken, the course number, the course title, and the number of credit hours.

University	Course Number	Title	Quarter Credit Hours	Semester Credit Hours
		Quarter Credit Hours Sub Total		
		Semester Credit Hours Sub Total		

Total Basic Science Credits (Qtr Credits + (1.5 × Sem Credits)):

(24 required)

III. General Education

A. A minimum of 24-quarter credit hours or 16 semester credit hours is required in subjects other than mathematics, basic science, computer science, and engineering. These general education courses should complement the technical content of the curriculum. Examples of traditional subjects in these areas are philosophy, religions, history, literature, fine arts, sociology, psychology, political science, anthropology, economics, and foreign language. Examples of non-acceptable courses include accounting, industrial management, finance, personnel administration, engineering economy, physical education and military science and training.

University	Course Number	Title	Quarter Credit Hours	Semester Credit Hours
		Quarter Credit Hours Sub Total		
		Semester Credit Hours Sub Total		

Total General Education Credits (Qtr Credits + (1.5 × Sem Credits)):

(24 required)

IV. Engineering Science and Engineering Design

A minimum of 72 quarter credit hours or 48 semester credit hours of engineering science and design are required. Of those 54 quarter credit hours or 36 of the semester hours must be specifically in Mechanical Engineering and include both Thermal and Mechanical Systems.

A. List all **Mechanical Engineering** courses passed with a grade of C or better. A minimum of 54 quarter hours or 36 semester hours are required. For each course, indicate the college or university where the course was taken, the course number, the course title, and the number of credit hours (weekly lecture hours plus one half of lab hours). Courses must include Thermal Systems and Mechanical Systems.

University	Course Number	Title	Quarter Credit Hours	Semester Credit Hours
		Quarter Credit Hours Sub Total		
		Semester Credit Hours Sub Total		

Total Mechanical Engr Credits (Qtr Credits + (1.5 × Sem Credits)):

(54 required)

B. List all engineering courses **not** in Mechanical Engineering passed with a grade of C or better. For each course, indicate the college or university where the course was taken, the course number, the course title, and the number of credit hours. Combined with the above Mechanical Engineering Courses, a minimum of 72 quarter hours or 48 semester hours is required.

University	Course Number	Title	Quarter Credit Hours	Semester Credit Hours
		Quarter Credit Hours Sub Total		
		Semester Credit Hours Sub Total		

Total Non-Mech Engineering Credits (Qtr Credits + (1.5 × Sem Credits)):

C. Also, DoD officers are entitled to certain college credit based on service schools attended (Nuke Power School, DCA School, MPA School, etc.) If you have attended any technical DoD schools, including in a prior enlisted status, list those service schools by Title. See your Program Officer for evaluation of those courses based on publications by the American Council on Education. If applicaple, the Engineering Science Hours may be added to the total as identified below.

Service School Title	Course Number	Mech Engr Semester Credit Hours	Eng Science Semester Credit Hours
Total Service Related Mechanical Engr Science Credit Hours			
Convert Semester Hours to Quarter Hours (1.5 x Sem Hours): Mech Engr Science Service Qtr Credit Hours			
Total Service Related Engr Science Credit Hours			
Convert Semester Hours to Quarter Hours (1.5 x Sem Hours): Engr Science Service Qtr Credit Hours			

D. Total Engineering Science Credit Hours:

Total Mechanical Engineering Science Credits (Sect IV. A. Previous Pages + Service Related Mechanical Engineering Science Hours Above):

(54 required)

Total Non-Mech Engineering Credits (Sect IV. B. Previous Pages + Service Related Non-Mechanical Engineering Science Hours Above):

Total Engineering Science Credits (sum above):

(72 required)

V. A major design experience at the advanced undergraduate level is required. It shall be based on the knowledge and skills acquired in earlier course work and incorporating engineering standards and realistic constraints. Briefly describe your major design experience. This requirement can be satisfied by completing a course with a major design experience that has been previously approved by the NPS ME department curriculum committee.

THESIS PROPOSAL APPROVAL FORM

Name:

A. Curriculum:

B. Month/Yr. of Graduation:

C. Degree:

D. Tentative Thesis Title:

E. Thesis Advisor:

F. Co-Advisor/Second Reader:

G. Anticipated Funding Requirements (if any):

Funding Provided by:

H. Thesis Classification:

Specialization Track:

Please answer items "I" through "N" on page 3
Descriptions of these items are on the following page.

Approved. Advisor: _____ Date: _____

Approved. Co-Advisor/2nd Reader: _____ Date: _____

Approved. Acad. Assoc.: _____ Date: _____

Approved. Chairman: _____ Date: _____

Noted/Date: _____ Program Officer: _____

I. Research Questions

Identify the primary research question and subsidiary research questions. The primary research questions should be broad enough that it covers the entire spectrum of the research activity. Subsidiary research questions subdivide the primary research question into manageable research segments. This should be a very explicit statement of the questions the research will seek to answer. While the questions may be redefined later as the research progresses, initial objective should be made specific.

J. Discussion of Topic

Describe the main thrust of the study, what areas will be specifically investigated and what areas will be excluded; put boundaries around the study; identify what the study will be (e.g., a computer simulation, an experiment, an electronic design and implementation, a system study); discuss any limitations of the study.

K. Tentative Chapter Outline

Identify tentative chapter headings and provide brief discussion of chapter content (Note: This can change).

L. Benefit of Study

State of the contribution expected from your research efforts, what individuals/organizations will use the results of your thesis and what problems/issues you feel will be addressed/resolved.

M. Preliminary Bibliography

Provide a listing of representative materials consulted during preliminary literature search. This should include references to the problem or issue to be studied, prior thesis work, literature references, or other sources of information. The final bibliography will probably be much more extensive.

N. Milestones

This is a tentative list of target dates for completion of the successive stages of the project. You will not be held strictly to this schedule; it is a means of conveying to other when you expect to complete major milestones of the study. Give the dates during which the following activities will be accomplished.

(1.) Literature Review
(2.) Construct Research Approach
(3.) Conduct Research/Travel
(4.) Analyze Data
(5.) Draft Thesis
(6.) Final Thesis Submission Signature

I. Research Questions

J. Discussion of Topic

K. Tentative Chapter Outline

L. Benefit of Study

M. Preliminary Bibliography

N. Milestones