



NAVAL
POSTGRADUATE
SCHOOL

STUDENT GUIDE

Curriculum 570
Naval-Mechanical Engineering

<https://my.nps.edu/web/mae/students>

Department of
Mechanical & Aerospace Engineering

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1. Introduction

This document provides a guide to the resident Mechanical Engineering degree programs in the Department of Mechanical & Aerospace Engineering (MAE) Department. Separate guides are available for Distance Learning programs, the Aerospace 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 Richard Arledge ----- Program Officer (x-2033)
- Prof. Joshua H. Gordis ----- Academic Associate (x-2866)
- Prof. Garth V. Hobson----- Chairman (x-2888)
- Prof. Brian Bingham----- Associate Chairman (831-200-6360)

Acronyms:

- ABET.....Accreditation Board for Engineering and Technology
- BS Bachelor of Science
- BSMEBachelor 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
- TSSETotal Ship Systems Engineering

2. Welcome Aboard

2.1. Message from the Chairman

Welcome to the Department of Mechanical and Aerospace 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.

Garth V. Hobson, Ph.D.
Chairman, Department of Mechanical & Aerospace 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 Aerospace Engineering Department, I would like to take this opportunity to congratulate each 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. I hope that you take

advantage of the many recreational activities, from kayaking in Elkhorn Slough to hiking at Yosemite.

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, Ed Tech 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 a significant graduation requirement. You choose the area for thesis research and your advisor. Do not take this decision lightly. Start your search early by meeting the faculty and learning about current research that is being conducted in the department. You may be able to continue existing research. Your knowledge of fleet problems or a personal interest that you want to explore are other great options! Any of these paths 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. My door is always open and I look forward to continued interaction with each and every one of you.

Welcome Aboard!

Richard Arledge
CDR USN
Program Officer, Mechanical Engineering

3. Program 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, in support of national security.

In order to achieve this goal, the specific educational objectives are to produce alumni who are expected to achieve the following within a few years of graduation:

- 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.
- 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.
- 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/MS1xxx/TS1xxx – Introductory undergraduate-level class

ME2xxx/AE2xxx/MS2xxx/TS2xxx – Undergraduate-level class

ME3xxx/AE3xxx/MS3xxx/TS3xxx – Advanced undergraduate or introductory graduate-level class

ME4xxx/AE4xxx/MS4xxx/TS4xxx – Graduate-level class

The course catalog (either the print version or Python) indicates 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:

$$\text{QCH} = \text{Lecture Hours} + \frac{1}{2} * \text{Laboratory Hours}$$

Upon successful completion of ME2201, you will earn $3 + \frac{1}{2} * 2 = 4$ 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.

4.2. 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 7.2** 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 5.5** 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 & Aerospace 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.

4.3. 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).

4.4. 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 92 (coursework + thesis).

4.5. 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

4.6. 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 generally, count towards MSME degree requirements. The appropriate degree thesis requirements must be met, but a thesis 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 seven courses:

TS3000	Electrical Power Engineering (3-2)
TS3002	Principles of Ship Design and Case Studies (3-2)
TS3003	Naval Combat System Elements (3-2)

TS4000	Naval Combat System Engineering (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 seven courses to your matrix. Note that TS4001 and TS4003 can serve as two of the required three 4000-level classes. The third required 4000-level elective must come from a different specialization track (i.e. not a TS class).

Also note:

- TS3001, TS4001, TS4002, TS4003 earn ME credit.
- TS3000, TS3002, TS3003, TS4000 earn non-mechanical engineering credit.
- TS3000 can replace EO2102 to satisfy the electrical engineering ESR.
- TS4003 can replace ME3712 to satisfy ABET BSME equivalency requirements.

If you successfully complete the TSSE program, you are eligible to earn the 5602 P-code. For further information, see Professor Jarema Didoszak, 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.” It is 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 the crowning achievement of your graduate study, and will be your introduction to the community of scholars.

5.2. Finding a Thesis Topic and Thesis Advisor

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 by the completion of your fourth quarter.

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. 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.

5.3. Thesis Proposal Preparation

No later than in your fourth quarter, you will be enrolled in the class ME1810 - Thesis Proposal Preparation. This class is taken pass/fail, and there are no formal meetings. A passing grade in this class is obtained by finding a thesis topic and thesis advisor, and completing two forms. The first form is a hard copy form, the Thesis Plan with Advisors (TPA) form. Once completed, this form must be routed for signatures. It is the student's responsibility to make sure all required signatures are obtained. The completed and fully signed form should be returned to the Educational Technician.

The second form is electronic, the Thesis Proposal Form (TPF) and is filled out on your Python Thesis Dashboard.

To summarize, by the end of your fourth quarter, to earn a passing grade in the class, ME1810 - Thesis Proposal Preparation, you will have found a thesis topic and advisor, and have completed both the Thesis Plan with Advisors (TPA) and Thesis Proposal Form (TPF). Of course, if you find a thesis and advisor prior to the fourth quarter, that is to your advantage.

5.4. What happens next?

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.

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. Research goals 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 means 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, it has significant deficiencies. 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.

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 MAE 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 at <https://www.nps.edu/Research/research1.html>. You are encouraged to also make use of the Graduate Writing Center at NPS.

5.5. Choosing 4000-Level Electives and a Thesis Track

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 “open slots” reserved for this. 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 “specialization tracks”:

- Fluids-Thermal Sciences
- Solid Mechanics, Shock and Vibration
- Materials Science
- Dynamics and Controls
- System Design (Weaponizing, Survivability)
- Astronautics (Controls & Structures)

You are required to choose at least two of three 4000-level electives from the courses listed in one of the above tracks, and your third elective may, but is not required to 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. Your third 4000-level elective must come from a different specialization area.

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 quarters 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.

QTR	To Do
1	<p>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 8.3 through 8.5. 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.</p> <p>Fill out your first draft of the BSME Equivalency form in the (Appendices) and the MSME Checklist. Bring to Program Officer and Academic Associate for review.</p>
2	Start interviewing the faculty members in order to identify potential thesis topics . Make sure you read Section 5 , Your Thesis, before you do that.
3	
4	<p>Take the class ME1810 - Thesis Proposal Preparation. Pick your Thesis Advisor/Topic. This determines your area of specialization (i.e. “track”). Select and schedule your electives (See Section 5.5). Complete the forms “Thesis Plan with Advisors (TPA)” (hardcopy) and the “Thesis Proposal Form (TPF)” (electronic, Thesis Dashboard in Python). See Section 5.2 of this Guide. The Dept. Chair requires all Thesis Proposals to be signed before commencement of your first thesis slot.</p>
5	Start working on your thesis.
6	Typically, ME0810 is first scheduled in this quarter.
7	Fill out final versions of the BSME Equivalency Form and MSME Checklist , and route them for signatures.
8	Fill out the MSME Degree Program Exit Survey.
<p>After you graduate. Please keep in touch. Let us know when you reach important milestones in your career, change career paths, etc.</p>	

6.1. 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)
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 7.1).

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. 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. Of note is ESR-12, which defines five technical ‘tracks’ from which each student must choose two. Refer to the document, “[MAE MSME Matrix with Tracks \(Placemat\), June 2019.](#)” This document defines the “core” courses which make up the ESRs along with the five technical “tracks,” and the courses which comprise each track. The student will complete all ‘core’ courses, and must complete all 3xxx-level courses in two of the five tracks. Typically, one of the

selected tracks will be your thesis track, and the other track can also support your thesis, or support career goals, personal interest, etc. To summarize, the P-Code can be earned by completing all 570 core courses and all 3xxx-levels as contained in two of the five technical tracks.

The following is 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 program officer and the academic associate. However, each student will be exposed to fundamentals in all ESR areas.

ESR-1: THERMODYNAMICS: Fundamentals of thermodynamics with applications to all marine engineering power cycles as well as propulsion and auxiliary system cycle analysis and design.

Required Course #	Description	Alternate Course
ME2101	Thermodynamics (4-1)	Undergraduate
ME3240	Marine Power and Propulsion (4-2)	

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

Required Course #	Description	Alternate Course
ME2201	Introduction to Fluid Dynamics (3-2)	Undergraduate

ESR-3: DYNAMICS AND CONTROL 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. Theory and practice of control systems engineering, including analysis and design of feedback systems. Use of linear systems concepts for modeling dynamic systems, designing feedback control and assessing system performance with applications to the design of feedback for naval component, process, platform, and weapon systems.

Required Course #	Description	Alternate Course
ME2502	Dynamics (4-1)	Undergraduate
ME2801	Introduction to Control Systems (3-2)	EC2300

ESR-4: STRUCTURAL MECHANICS: Statically determinant and indeterminate structural analysis, stress/strain analysis, buckling, and failure; with applications to marine structures, including surface ships and submarines.

Required Course #	Description	Alternate Course
ME2501	Statics (3-0)	Undergraduate
ME2601	Solid Mechanics I (3-2)	Undergraduate

ESR-5: MATERIALS SCIENCE AND ENGINEERING: Material microstructure-property correlations, their association with fabrication and processing steps and applicability of those concepts to engineering materials of Naval relevance. The materials selection process, design, production (including additive manufacturing approaches), characterization of properties and analysis of failure mechanisms.

Required Course #	Description	Alternate Course
MS2201	Engineering Materials (3-2)	Undergraduate
MS3202	Failure Analysis and Prevention (3-2)	
MS3304 or MS3606	Corrosion and Marine Environment Degradation (3-2) OR Introduction to Welding and Joining Metallurgy	MS3606 or MS3304

ESR-6: ENGINEERING MODELING AND ANALYSIS: Practical experience of structured programming languages and the use of integrated design tools for computational and symbolic manipulation. Exposure to finite element and finite difference tools and techniques, with application to the thermo-fluid and structural mechanics/dynamics areas, including experience with representative software packages.

Required Course #	Description	Alternate Course
AE2440	Matlab (3-2)	ME3440
MA3232	Numerical Analysis (3-2)	ME3440
OR ME3440 can be substituted for both AE2440 and MA3232	Engineering Analysis (4-0)	

ESR-7: MATHEMATICS: A basic understanding of statistics, multivariable and vector calculus, matrix and linear algebra, differential equations, partial differential equations, and numerical methods and their applications in mechanical engineering fields of study.

Required Course #	Description	Alternate Course
MA1115	Multi-variable Calculus (4-0)	Undergraduate

MA1116	Vector Calculus (4-0)	Undergraduate
MA2043	Introduction to Linear and Matrix Algebra (4-0)	Undergraduate
MA2121	Differential Equations (4-0)	Undergraduate
MA3132	Partial Differential Equations (4-0)	
MA3232	Numerical Analysis (3-2)	ME3440

ESR-8: DESIGN/SYNTHESIS: Design synthesis, with emphasis on the design of mechanical subsystems and their integration into the ship system, including use cases and fatigue.

Required Course #	Description	Alternate Course(s)
ME3711	Design of Machine Elements (4-1)	
ME3712	Capstone Design Project (1-6)	Undergraduate Design Project, TS4003

ESR-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 multi-phased circuits.

Required Course #	Description	Alternate Course(s)
EO2102	Introduction to Circuit and Power System Analysis (4-2)	Undergraduate
		TS3000
		NU3009

ESR-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 sea keeping and survivability principles.

Required Course #	Description	Alternate Course
TS3001	Fundamental Principles in Naval Architecture (3-2)	Undergraduate

ESR-11: CYBER: Fundamentals of the underlying principles of cyber infrastructure and systems, inherent vulnerabilities and threats including Industrial Control Systems, and defensive security procedures. (* ESR required for 14XX designators only)

Required Course #	Description	Alternate Course
EO2701	Introduction to Cyber Systems (4-2)	Undergraduate, EC2700

ESR-12: SPECIALIZATION: Each student will also acquire technical competence in two or more of the following specialization areas through additional graduate level courses and their associated prerequisites:

1. Fluids, Thermodynamics, and Heat Transfer
2. Autonomy and Control Systems
3. Solids and Structures
4. Material Science
5. Design/Total Ship Systems Engineering

For Track 1: Fluids, Thermodynamics, and Heat Transfer, the following courses are required. These are to include material covering heat transfer, as well as naval applications within propulsion and auxiliary system cycle analysis and design.

Required Course #	Description	Alternate Course
ME3201	Applied Fluid Mechanics (4-1)	
ME3150	Heat Transfer (4-1)	
ME3450	Computational Methods in Mechanical Engineering (3-2)	
ME4XXX	Specialization Elective	
ME4XXX	Specialization Elective	
ME4XXX	Specialization Elective	

For Track 2: Autonomy and Control Systems, the following courses are required. These are to include material covering navigation and control for single and network-centric systems, as well as design of intelligent systems for machinery monitoring and automation, and autonomous vehicle operations within a naval domain.

Required Course #	Description	Alternate Course
ME3801	Dynamics and Control of Marine and Autonomous Vehicles I (3-2)	
ME3720	Introduction to Unmanned Systems (3-2)	
ME4XXX	Specialization Elective	
ME4XXX	Specialization Elective	
ME4XXX	Specialization Elective	

For Track 3: Solids and Structures, the following courses are required. These are to include material covering design optimization, fatigue, and shock and vibration response of marine structures, including surface ships and submarines.

Required Course #	Description	Alternate Course
ME3521	Mechanical Vibration (3-2)	
ME3611	Mechanics of Solids II (4-0)	

ME3450	Computational Methods in Mechanical Engineering (3-2)	
ME4XXX	Specialization Elective	
ME4XXX	Specialization Elective	
ME4XXX	Specialization Elective	

For Track 4: Materials Science, the following courses are required. These are to include courses in both welding and corrosion.

Required Course #	Description	Alternate Course
MS3304	Corrosion and Marine Environment Degradation (3-2)	
MS3606	Introduction to Welding and Joining Metallurgy (3-2)	
MS4XXX	Specialization Elective	
MS4XXX	Specialization Elective	
MS4XXX	Specialization Elective	

For Track 5: Design/Total Ship Systems Engineering, the following courses are required. This track awards the 5602P subspecialty code:

Required Course #	Description	Alternate Course
TS3000	Electrical Power Engineering (3-2)	
TS3002	Principles of Ship Design and Case Studies (3-2)	SE3100
TS3003	Naval Combat System Elements (3-2)	
TS4000	Naval Combat System Engineering (3-2)	SE4112
TS4001	Integration of Naval Engineering Systems (3-2)	
TS4002	Ship Design Integration (2-4)	
TS4003	Total Ship Systems Engineering (2-4)	
ME4XXX	Specialization Elective	

ESR-13: ADVANCED TOPICS: All students must take at least one graduate-level course that exposes them to cutting-edge technology with military application of Mechanical Engineering. Courses that satisfy this requirement do not need to be within the MAE Department, and are at the discretion of the Program Officer or SME. Topics can include, but are not limited to, Alternative Energy, Nano-scale machines (MEMS), Artificial Intelligence/Machine Learning, Design Optimization, Modeling and Simulation, Additive Manufacturing (3D printing), Quantum Computing, Electric Propulsion and

Hypersonics.

ESR-14: 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.

Required Course #	Description	Alternate Course
ME0810	Thesis Research (0-8)	
ME0810	Thesis Research (0-8)	
ME0810	Thesis Research (0-8)	
ME0810	Thesis Research (0-8)	
ME0810 *	* Up to two additional thesis blocks may be added. (Requires approval of MAE Chair)	
ME0810 *		

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.

7.1. 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 4.2) awarded reflects this accreditation. The MSES degree (Section 4.3) 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.

7.2. 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 must have earned a grade of C- or higher in any class you include. 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. See the file, “MAE Matrix with Tracks,

June 2019.” This matrix is generic, and must be modified by you with the advice and consent of the Program Officer and Academic Associate. This generic matrix “template” contains the ME core courses which all students must take (with some exceptions, discussed in what follows). See the matrix depicted below in Figure 1. Note that the first quarter, denoted by “Rfr” in the left column, is applicable only to students who have been assigned a refresher quarter. For most students, your first quarter is actually labelled “W(2)”. For those students who possess an ABET-accredited B.S.M.E degree, you may validate the course “ME3711 Design of Machine Elements” and also drop the course, ‘ME3712 Capstone Design Project.’ Also, those students who have had an introductory-level course in Electric Circuit Theory (AC/DC) may drop the course, “EO2102 Basic Electronics and Electrical Machines.”

In addition to the ME core courses, each student must select an additional two specialization tracks. These are shown in Figure 2. The 3xxx-level classes in the two selected tracks must be added to your core course matrix. Typically, one of these two specialization tracks will be in the technical area of your thesis, i.e. your thesis specialization track. Your second selected track can be one which supports your thesis, or your future work, or personal interest. Once you have selected these two tracks, you must add all the 3xxx-level classes in each of these two tracks to your core matrix. This is done in Python, and attention must be paid to the teaching schedule, to ensure that you are adding courses in the quarters in which they are offered. You are required to add at least three, 4xxx-level electives to your matrix. See Section 5.5, “Choosing 4000-Level Electives and Thesis Tracks.” The ME core courses along with the 3xxx-level classes in the two selected tracks meet the requirements for the P-Code (See Section 7, “Educational Skill Requirements (ESRs) and the Subspecialty Codes (P-Codes).”

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 MAE Dept Teaching Schedule (see either the Program Officer or the Academic Associate).

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, but does not count towards your required course load of four courses per 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 6.1, 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 at least 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.

QTR	ME Core Classes <i>*570 students must take (or validate) all core classes, plus all 3000-level classes in two of five Specialization Tracks</i>			
F (1) Rfr	MA1113 (4-0) (1,2,3,4) Single Variable Calculus I	MA1114 (4-0) (1,2,3,4) Single Variable Calculus II with Matrix Algebra	ME2501 (4-1) (1,3) Statics (MA1113/4-C)	AE2440 (3-2) (1,3) Intro to Digital Computation Or EC2440 (2,4)
W (2)	MA1115 (4-0) (1,2,3,4) Multi-Variable Calculus (MA1113-4/EQ)	MA1116 (3-0) (1,2,3,4) Vector Calculus (MA1113-4/EQ)	ME2502 (4-1) (2, 4) Engineering Dynamics (ME2501)	ME2601 (4-1) (2,4) Mechanics of Solids I (ME2501 and MA1114/EQ)
Sp (3)	MA2121 (4-0) (1,2,3,4) Diff Equations (MA1114)	MA2043 (4-0) (1,3) Intro to Matrix and Linear Algebra	ME2801 (3-2) (1,3) Sys Dynamics (AE2440 / MA2121-C)	ME2101 (4-2) (1,3) Thermodynamics (MA1115)
Su (4)	MA3232 (4-0) (2,4) Numerical Analysis (MA1115/MA2121)	ME2201 (3-2) (2,4) Intro to Fluid Mechanics (ME2502)	MS2201 (3-2) (2,4) Engineering Materials (Undergrad courses in calc, physics and chem.)	EO2102 (4-2) (2,4) Basic Electronics and Electrical Machines (MA2121)
F (1)	MA3132 (4-0) (1,2,3,4) Partial Diff Eqns. (MA2121/MA1116)	MS3202 (3-2) (1,3) Prop, Perf and Failure of Eng Materials (MS2201/EQ)		
W (2)	ME3711 (4-1) (2) Design of Machine Elements (ME2201, ME2601)	ME3240 (4-2) (2,4) Marine Power and Propulsion (ME2101/ ME2201)	Any ME4XXX Specialization Elective (ask your advisor)	
Sp (3)	ME0810 (0-8) Thesis	MS3304 (3-2) (3), Corrosion OR MS3606 (3-2) (1) Intro to Welding and Joining Metallurgy	Any ME4XXX Specialization Elective (ask your advisor)	
Su (4)	ME0810 (0-8) Thesis	ME0810 (0-8) Thesis	TS3001 (3-2) (2,4) Fund Principles of Naval Architecture (ME2201/ME2601)	Any ME4XXX Specialization Elective (ask your advisor)
F (1)	ME0810 (0-8) Thesis	ME3712 (4-2) (1) Capstone Design project (ME3150, ME3450, ME3521, ME3711)		

Figure 1. ME Core Course Matrix

TRACK #1: Fluids, Thermodynamics and Heat Transfer Specialization Track		TRACK #2: Control Systems Specialization Track		TRACK #3: Solids & Structures Specialization Track		TRACK #4: Materials Science Specialization Track		TRACK #5: Design / Total Ship Systems Engineering (TSSE) Specialization Track	
required 3000-level	electives	required 3000-level	electives	required 3000-level	electives	required 3000-level	electives	required 3000-level	required 4000-level
ME3201 (4-1) (1,3) Applied Fluid Mechanics (ME2101/ME2201/ MA3132-C)		ME3801 (3-2) (2,4) Automatic Controls (ME2801)		ME3611 (4-0) (1,3) Mechanics of Solids II (ME2601)		MS3304, Corrosion OR MS3606, Welding (Materials Track students must take both)		SE3100 (3-2) (1,3) Fundamentals of Systems Engineering OR TS3002	
ME3150 (4-1) (2,4) Heat Transfer (ME2101/ME2201/ MA3132-C)	ME400X Track #1 Specialization Elective	ME3720 (3-2) (2) Intro to Unmanned Systems	ME400X Track #2 Specialization Elective	ME3521 (3-2) (2,4) Mechanical Vibrations (ME2503/ ME2601/ MA2121)	ME400X Track #3 Specialization Elective	MS300X TBD New Materials Course	MS400X Track #4 Specialization Elective	TS3000 (4-2) (1) Basic Electronics and Electrical Machines	TS4000 (3-2) (3) Naval Combat System Engineering (TS3000/ TS3003)
ME3450 (3-2) (1,3) Comp Methods in Mechanical Eng (ME2101/ME2601/ ME2201/ MA3132)	ME400X Track #1 Specialization Elective		ME400X Track #2 Specialization Elective	ME3450 (3-2) (1,3) Comp Methods in Mechanical Eng (ME2101/ME2601/ ME2201/ MA3132)	ME400X Track #3 Specialization Elective		MS400X Track #4 Specialization Elective	TS3003 (3-2) (2,4) Naval Combat System Elements	TS4001 (3-2) (3) Integration of Naval Engineering Systems (TS3000/ TS3001/ TS3002)
	ME400X Track #1 Specialization Elective		ME400X Track #2 Specialization Elective		ME400X Track #3 Specialization Elective		MS400X Track #4 Specialization Elective		TS4002 (2-4) (4) Ship Design Integration (TS4001/ TS4000)
									TS4003 (2-4) (1) Total Ship Systems Engineering (TS4002)

Figure 2. Specialization Tracks

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 thesis 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.
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 Academic Associate and Program Officer for their approval.

Once approved, the validated course is excluded from calculation of the total lecture/lab hours and credit; the validated course will remain in your matrix in yellow.

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 P-Code (Section 7)
- Meeting ABET requirements (Section 7.1)
- Prerequisites for follow-on courses (e.g. 4000-level classes)
- Maintaining a full course load each quarter

8.3. 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 7.2). 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).

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 4.6), which requires six 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).

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), 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) requires each student 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.

AE2440 (or EC2440) 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 not take this course. 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 a previous section (Section 7.2), 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. Typically, this form requires 3 ME3xxx courses, 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). You must have earned a grade of C- or higher in any class you include on the MSME checklist. Once a class is listed on your MSME Checklist, you may not list them on your BSME Equivalency form. Your remaining ME/AE/MS/TS 2000- and 3000-level 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 must have earned a grade of C or higher in any class you include in the BSME equivalency 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. Supporting Documents

- 10.1 **MSME Checklist** – This checklist must be filled out by every student. It is an accounting of which courses taken are being used to satisfy M.S. degree requirements. No courses which appear on the MSME checklist can appear on the BSME equivalency form, nor can be used for any other degree.
- 10.2 **BSME Equivalency Form** – This form is used to demonstrate that a student has taken sufficient courses either at other institutions and/or at NPS that constitute equivalency with an ABET-accredited BSME degree. For those students that have an ABET-accredited BSME degree, only the first page of the form must be filled out.
- 10.3 **Thesis Plan with Advisors Form** – *this form is used to formally establish your thesis plan. It documents the (tentative) thesis title and the thesis advisor and is filled out in coordination with your thesis advisor.*
- 10.4 **[MAE MSME Matrix with Tracks \(“Placemat”\), June 2019](#)** – *This is the ME (570) matrix which defines the core courses all students must take, along with the thesis specialization tracks.*