

Embedded Systems Hardware (ENPM818G) Sections 0101 and EB01

Term: *Spring 2026*

Professor: Manoj Franklin

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Office Hours: After class; also by Zoom appointment

Credits: 3

Course Dates: From January 26, 2026 – May 19, 2026

Course Times: Mondays from 7:00 pm – 9:40 pm

Classroom: JMP 2116 and online

[ENPM818G Canvas Course Space](#)

Course Description

Basics of logic designs leading to design of processors, memory, communication ports as well as multiprocessor systems enriched with design examples. Topics include embedded system modeling, hardware description languages (Verilog), dedicated hardware designs, and single-core, multi-core, and accelerator processing elements. Real-life embedded systems hardware design examples will be used throughout the course to illustrate these concepts and to prepare students for a future career in embedded systems design.

Prerequisites

Must have completed undergraduate courses in logic design, computer organization, and programming.

Must have taken ENPM615 or equivalent, or be taking it concurrently.

Learning Outcomes

After successfully completing this course, you will be able to:

- Model the computational and communication requirements of an embedded system and select the most appropriate model(s)
- Identify criteria for verifying and evaluating a design
- Design a real-time embedded system by considering hardware-software trade-offs
- Select from alternatives based on microprocessors, accelerators, dedicated hardware, and software to implement an embedded system
- Perform digital logic design of dedicated hardware circuits using hardware description language
- Describe and analyze a project design in written reports and oral presentations

Course Materials

Required Resources

- Book: None
- Application/Software: An FPGA board (Required; estimated cost: varies).

Supplemental Resources (no purchase required)

- Readings:
 1. Frank Vahid and Tony Givargis, Embedded System Design: A Unified Hardware / Software Introduction, ISBN: 978-0-471-38678-0.
 2. Edward Ashford Lee and Sanjit Arunkumar Seshia, Introduction to Embedded Systems: A Cyber-Physical Approach, 2/e, MIT Press, ISBN: 978-0-262-53381-2.
- Hardware/Software: None

Course Structure

This course includes both on-campus and online sections. To attend synchronously online, log into ELMS-Canvas at the time of the Section 0101 class [Mon 7:00pm] and select “Video Conference” from the left side menu. This will open a Zoom link to the live classroom. All lectures will be recorded and made available on ELMS-Canvas under “Panopto Recordings/Video Lectures” within 24 hours of the class time.

Please note that F1 students enrolled in the on-campus section are required to attend in person. If you have a conflict on a particular day, please reach out to me in advance to discuss.

Communication Guidelines

Communicating with the Instructor

I can be reached by email at manoj@umd.edu. Please feel free to reach out about personal, academic, and intellectual concerns/questions. I will also be available after class.

Finally, if you need to discuss issues not appropriate for the classroom and/or an email, we can arrange to talk by phone, over Zoom, or in person. Send me an email asking for a meeting and we can set something up.

Announcements

I will send IMPORTANT messages, announcements, and updates through ELMS-Canvas. To ensure you receive this information in a timely fashion, make sure your email and announcement notifications (including changes in assignments and/or due dates) are enabled in ELMS-Canvas ([How to change notification settings in CANVAS](#)).

Log into our ELMS-Canvas course site at least once every 24-hour period to check your inbox and the Announcements page.

Grading

Grade Breakdown

Assignment	Percentage %
Homework Assignments	30%
Exam	40%
Project/Paper/Presentation	30%
Total	100%

Course Assignments

Homework Assignments

- Design and implement a specific task in the development board used for this course
- The task will be geared for students to get hands on experience

Exam

- Will cover Ch 1-7
- Will test knowledge and understanding of the topics

Project

- Propose, design, and implement a project in the development board acquired for the course
- Write a short description of the project, its design, the experimental results, and the conclusion
- Give a presentation of the project

Grading of Assignments

All assignments will be graded according to a predetermined set of criteria (i.e., rubric) which will be communicated to students before the assignment is submitted.

It is my intention to grade all assignments within 2 weeks of their due date.

Grade Computation

All assessment scores will be posted on ELMS/Canvas page. If you would like to review any of your grades (including the exam), or have questions about how something was scored, please email me to schedule a time for us to meet and discuss.

Grade Disputes: I am happy to discuss any of your grades with you, and if I have made a mistake, I will immediately correct it. Any formal grade disputes must be submitted in writing and within one week of receiving the grade.

Final letter grades are assigned based on the percentage of total assessment points earned. Being close to a cutoff is not the same as making the cutoff (89.99 \neq 90.00).

Final Grade Cutoffs

Letter Grade	Cutoff
A+	97%
A	94%
A-	90%
B+	87%
B	84%
B-	80%
C+	77%
C	74%
C-	70%
D+	67%
D	64%
D-	60%
F	<60%

Course Schedule

Week #	Topic	Deliverable
1	Introduction	Feb 2, 2026
2	Embedded System Modeling	Feb 9, 2026
3	Hardware Description Languages	Feb 16, 2026
4	Dedicated Hardware Design	Feb 23, 2026
5	Single-core and Multi-core Processors	Mar 2, 2026
6	DSPs, GPUs, and Accelerators	Mar 9, 2026
7	System-level Design	Mar 23, 2026
8	Example ES Design: Digital Camera	Mar 30, 2026
1 - 7	Exam 1	Apr 6, 2026
9	Design Verification and Validation	Apr 13, 2026
10	Reliability and Fault-Tolerance	Apr 20, 2026
11	Power and Energy Management	Apr 27, 2026
12	Project Demo	May 4, 2026

Note: This is a tentative schedule, and subject to change as necessary – monitor ELMS-Canvas for current deadlines. In the unlikely event of a prolonged university closing, or an extended absence from the university, adjustments to the course schedule, deadlines, and assignments will be made based on the duration of the closing and the specific dates missed.

Course Policies and Procedures

For a complete list of graduate course related policies, visit the [Graduate School website](#). Below are course-specific policies and procedures which explain how these Graduate School policies will be implemented in this class.

Questions about Assignments

Please ask any detailed questions about an assignment during office hours or after lectures.

Late Work Policy

Assignments should be completed by the due date and time listed on ELMS. If you are unable to complete an assignment by the stated due date, it is your responsibility to contact me to discuss an extension, at least 24 hours BEFORE the assignment is due. Extensions are not guaranteed.

Assignments submitted late will receive a 10% deduction in total grade per each calendar day late up to a maximum of three days late (i.e., there is a maximum of a 30% grade reduction for assignments submitted late). Work submitted more than three days late will not receive feedback and will automatically earn a grade of zero.

Academic Integrity

Some of your assignments may be collected via Turnitin on ELMS/Canvas. This tool can help you improve your scholarly writing and help me verify the integrity of student work. For information about Turnitin, how it works, and the feedback reports you may have access to, visit [Turnitin Originality Checker for Students](#)

Please ensure that you fully understand the University's Code of Academic Integrity and its implications because all acts of academic dishonesty will be dealt with in accordance with the provisions of this code. It is your responsibility to read it and know what it says, so you can start your professional life on the right path. **As future professionals, your commitment to high ethical standards and honesty begins with your time at the University of Maryland.**

Course assistance websites, such as CourseHero, or AI generated content are not permitted sources. Material taken or copied from these sites can be deemed unauthorized material and a violation of academic integrity. Additionally, students may choose to use online forums for course-wide discussions (e.g., Group lists or chats) to discuss course concepts. However, **collaboration on graded assignments is strictly prohibited unless otherwise stated**. Examples of prohibited collaboration include: asking classmates for answers on assignments and exams, etc. Please visit the Office of Graduate Studies' full list of campus-wide policies and reach out if you have questions.

Finally, on each exam or assignment you must write out and sign the following pledge: ***"I pledge on my honor that I have not given or received any unauthorized assistance on this exam/assignment."***

If you ever feel pressured to comply with someone else's academic integrity violation, please reach out to me straight away. Also, if you are ever unclear about acceptable levels of collaboration, please ask!

Course Evaluation

Please submit a course evaluation through Student Feedback on Course Experiences in order to help faculty and administrators improve teaching and learning at Maryland. All information submitted to Course Experiences is confidential. Campus will notify you when Student Feedback on Course Experiences is open for you to complete your evaluations at the end of the semester. Please go directly to the [Student Feedback on Course Experiences](#) to complete your evaluations.

Religious Observance

It is the student's responsibility to inform the instructor of any intended absences for religious observances in advance. Notice should be provided as soon as possible but no later than the end of the schedule adjustment period.

Copyright Notice

Course materials are copyrighted and may not be reproduced for anything other than personal use without written permission.

Student Resources and Services

I encourage you to visit the [Counseling Center's Academic Resources](#) to learn more about the wide range of resources available to you. For a more comprehensive list, please visit the Graduate School's [Campus Resources Page](#).

Accessibility and Disability Services

The [Accessibility & Disability Service \(ADS\)](#) provides reasonable accommodations to qualified individuals to provide equal access to services, programs and activities. Any student who needs accommodations should contact me as soon as possible so that I have sufficient time to make arrangements.

For assistance in obtaining an accommodation, contact Accessibility and Disability Service at 301-314-7682, or email them at adsfrontdesk@umd.edu. Information about [sharing your accommodations with instructors, note taking assistance](#) and more is available from the [Counseling Center](#).

Digital Accessibility

The University of Maryland is committed to equal access to Web-based information and other information technology accessible to all users. If you are having trouble accessing the content on this Canvas site and need it in an alternative format or have comments or suggestions on accessibility, contact itaccessibility@umd.edu. For more information about accessibility at UMD, visit the [UMD Accessibility Website](#).

Notice of Mandatory Reporting

Notice of mandatory reporting of sexual assault, sexual harassment, interpersonal violence, and stalking: As a faculty member, I am designated as a "Responsible University Employee," and I must report all disclosures of sexual assault, sexual harassment, interpersonal violence, and stalking to UMD's Title IX Coordinator per University Policy on Sexual Harassment and Other Sexual Misconduct