Course Change Request

New Course Proposal

Date Submitted: 11/19/25 1:44 pm

Viewing: NEUR 432 : Neural Systems Design

Last edit: 01/14/26 12:20 pm

Changes proposed by: gscott21

In Workflow

1. **NEUR Chair**
2. **SC Curriculum Committee**
3. SC Assistant Dean
4. Assoc Provost-Undergraduate
5. Registrar-Courses
6. Banner

Approval Path

1. 12/16/25 3:23 pm Saleet Jafri (sjafri): Approved for NEUR Chair

Are you completing this form on someone else's behalf?

Yes

Requestor:

Name	Extension	Email
Sarojini Attili	3-1686	sattili@gmu.edu

Effective Term: Spring 2026

Subject Code: NEUR - Neuroscience

Course Number: 432

Bundled Courses:

Is this course replacing another course? No

Equivalent Courses:

Catalog Title: Neural Systems Design

Banner Title: Neural Systems Design

Will section titles vary by semester? No

Credits: 3

Schedule Type: Lecture

Hours of Lecture or Seminar per week: 3

Repeatable: May only be taken once for credit, limited to 2 attempts (N2)

Max Allowable Credits: 3

Default Grade Mode: Undergraduate Regular

Recommended Prerequisite(s):

BENG 313 Physiology for Engineers or BIOL 425 Human Physiology

Recommended Corequisite(s):

Required Prerequisite(s) / Corequisite(s) (Updates only):

BIOL 213 and Math 113 and a programming course (CS 112 or NEUR 431 or permission of instructor

Registrar's Office Use Only - Required Prerequisite(s)/Corequisite(s):

And/Or	(	Course/Test Code	Min Grade/Score	Academic Level	)	Concurrency?

Registration Restrictions (Updates only):

Registrar's Office Use Only - Registration Restrictions:

Field(s) of Study:

Class(es):

Level(s):

Degree(s):

School(s):

Catalog Description:

This course introduces the essential "design principles" of various parts of the mammalian nervous system. The recurring theme is that Evolution successfully managed to re-arrange the same building blocks (neurons, synaptic transmission, and membrane physiology) in different networks exquisitely tuned to their

functions, though often in incompletely understood ways. Topics include: neuronal biophysics, network architecture, cortical systems, neuroinformatics, and neurotechnology applications.

Justification:

Crosslist with BENG 350. This course will be an optional elective for NEUR majors, minors and the proposed computational neuroscience minor.

Does this course cover material which crosses into another department? Yes

Impacted Departments:

Department
BENG - Bioengineering

Learning Outcomes:

Students will be able to describe the structure and function of the basic building blocks of neural circuits that allows the central nervous system to fulfill its many functions, such as:
-motor control functions
-Sensory perceptions,
-cognitive functions such as learning and memory.
Students will be able to analyze the different spatial and temporal scales at which neurons and neuronal circuits operate and how engineering solutions leverage the guiding principles of neural architecture to solve problems in various fields, such as computing, robotics and artificial intelligence.
Students will be able to apply the course information and skills to real world engineering problems and be able to communicate and present their knowledge and analyses about these subjects in writing and orally.

Will this course be scheduled as a cross-level cross listed section? No

Attach Syllabus

beng350spring25ascoli.pdf
NEUR 432 BENG 350 Neural Systems Design.pdf

Additional Attachments

Presentation_topics25.pdf

Staffing:

Giorgio Ascoli, Sarojini Attili, Holger Dannenberg

Relationship to Existing Programs:

BENG 350 is a technical elective for BENG major/minor.

Relationship to Existing Courses:

Crosslisted with BENG 350

Have you reached out to the Libraries to determine whether there are adequate resources to support your course? If not, please email Meg Meiman, Associate University Librarian for Learning, Research, and Engagement at mmeiman2@gmu.edu.

Yes

Additional Comments:

Reviewer Comments

Key: 19139

Neural System Designs – NEUR 432/*BENG 350*

Prerequisites: BIOL 213 and BENG 214 (aka BENG 313) or permission of instructor.

Content and Goals: This course introduces essential architectural principles of the mammalian nervous system. The recurring theme is that Evolution successfully managed to re-arrange the same building blocks (neurons, synaptic transmission, and membrane physiology) in different networks exquisitely tuned to their functions, though often in incompletely understood ways.

Instructor: Giorgio A. Ascoli (ascoli@gmu.edu)

Teaching Assistant / Grader: Abdellah Akhrif (aakhrif@gmu.edu)

Class day/time & location: Tuesdays from 1:30pm to 4:10pm, Krasnow 229

Office hour day/time & location: Tuesdays from 12:30 to 1:30pm, Krasnow 223 or by appointment

Texts: Augustine, D., et al. (2023) Neuroscience, 7th Ed., Sinauer Associates. ISBN: 9780197616253
Ascoli, G.A. (2015) Trees of the Brain, Roots of the Mind, MIT Press. ISBN: 9780262028981

Technological requirements: Access to Blackboard and email.

(Approx.) Class Schedule of Topics

1/21 Introduction, class policies, learning goals, assignments, and assessment.
Systems architecture: CNS and non-invasive brain imaging; neurons & glia.
Assignments due 1/28: read TBRM Ch1&3; study TBRM Ch2 & wk1 slides.

1/28 Quiz on week 1 material.
Neuronal components: soma, axons, dendrites, synapses, myelin.
Membrane biophysics & electrophysiology: gradients, pumps, channels, cable, spikes.
Assignments due 2/4: study TBRM Ch3 & wk2 slides; read TBRM Ch4. Pick topic, meet team!

2/4 Quiz on week 2 material.
Synaptic machinery: vesicles, receptors, signals, and drugs.
Protagonists & supporters: principal cells, interneurons, and modulators.
Assignments due 2/11: study wk3 slides; read TBRM Ch5&6. Collect source material.

2/11 Quiz on week 3 material.
Neuronal diversity: transcriptomics, firing patterns, and connectomics.
From neural activity to behavior and cognition.
Assignments due 2/18: study wk4 slides; read TBRM Ch7&8. Draft report & organize refs.

2/18 Quiz on week 4 material.
Plasticity and memory: the ever-changing brain.
Associative conditioning, molecular mechanisms, & potential connections.
Assignments due 2/25: study wk5 slides; read TBRM Ch9; read Augustine Ch14. Start slides.

2/25 Quiz on week 5 material.
Review of neural foundations *[a. memristors, cmos, and fpgas]*
Olfaction & taste (des.: lateral inhibition enhances contrast) *[b. gas & liquid chromatography]*
Assignments due 3/4: study wk6 slides; study Augustine Ch14, read Augustine Ch16. Refine slides.

3/4 *Exam on neural foundations*

Spinal cord & Central Pattern Generation *[c. servo motor & robotic actuators]*
Assignments due 3/18: study wk7 slides; study Augustine Ch16, read Augustine Ch30. Refine report.

3/11 **SPRING BREAK**

3/18 Quiz on week 6+7 material.
Hippocampal formation (EC, DG, CA3, and CA1): grid & place cells *[d. GPS]*
Pattern separation, completion, comparison *[e. face/speech recognition, FAISS]*
Assignments due 4/1: study wk8 slides; study Augustine Ch30, read Augustine Ch27. Submit draft.

3/25 **(Optional but highly recommended) In-class team session with Abdellah – Work on projects**

4/1 Quiz on week 8 material.
Neocortex: functional modularity and specialization *[f. deep learning + applications]*
Language, semantic maps, & Amazon ads *[g. Alexa/Siri, Google knowledge graph, AI]*
Assignments due 4/8: study wk9 slides; study Augustine Ch27, read Augustine Ch19. Work on tips.

4/8 Quiz on week 9 material.
Cerebellum: error correction and ballistic action *[h. control theory & precision targeting]*
Grand review of circuits and functions.
Assignments due 4/15: study wk 10 slides; study Augustine Ch 19. Review Circuits and Functions.

4/15 *Exam on Circuits & Functions*
Marr's levels of analysis, rubrics & ethics discussion + presentation previews
Assignments due 4/22-29: complete & submit presentation written report & slides.

4/22 *Presentations y+a+b+c+d+f & ethics debate*

4/29 Presentations x+e+g+h+i *& ethics debate*

5/6 **READING WEEK**

5/13 *Final Cumulative Exam on Neural Foundations & Circuits and Functions (optional)*

Assessment: Weekly Quizzes (8x5mc@0.5pt ea) - 20 points
Neural Foundation Exam (40mc@0.5pt ea) - 20 points
Circuits & Functions Exam (40mc@0.5pt ea) - 20 points
Presentation written report & bibliographic search - 20 points
Presentation slides and delivery - 20 points
[Optional Final Exam (60mc@0.5pt ea) - 30 points]*

Grading: A, >93.3; A-, (86.6-93.3]; B+, (80-86.6]; B, (73.3-80]; B-, (66.6-73.3]; C+, (60-66.6]; C, (53.3-60]; C-, (46.6-53.3]; D, [33.3-46.6]; F, <33.3.

*The final exam will substitute half of the summed score of the 8 combined Quizzes, Neural Foundation Exam, and circuit & Function Exam if and only if this yields a higher grade. Otherwise, it is simply not considered.

Class communication: The instructor reserves the right to make any changes in the course he determines academically advisable. Changes will be announced in class and by *email solely through the students Mason account*. It is the student's responsibility to keep up with any changed policies.

Mandatory Attendance: Students are expected to attend class on time and participate in all discussions and activities for the whole duration of each lecture. Graded weekly quizzes will be at the beginning of each class, so punctuality is required. There will be no make-up quizzes/exams. Students

with an excused absence (sick with a doctor's note, death in the family, religious observance) should contact instructor before missing class/exams to discuss options for alternative arrangements. In the event of illness (including a positive Covid test), you must present a doctor, nurse, or pharmacist note stating that you were ill. Car/transportation trouble, traffic, routine doctor appointments, vacations, family travel, sport events, and any avoidable conflicts are not considered excused absences.

Writing Center: George Mason University provides a variety of resources and services (e.g., tutoring, workshops, writing guides, handbooks) for supporting students as they work to construct and share knowledge through writing. See writingcenter.gmu.edu

Academic Integrity: George Mason has an honor code with clear guidelines for academic integrity. Honesty expectation and requirement are taken very seriously, and breaches of this trust are treated gravely. Students must be responsible for their own work. When in doubt (of any kind) please ask for guidance and clarification. Cheating of any form is not tolerated. Students and faculty must take on the responsibility of dealing explicitly with violations.

Professional disposition: Students are expected to exhibit professional behavior at all times.

Disability Accommodations: If you have a documented learning disability or other condition that may affect academic performance you should: 1) make sure this documentation is on file with Office of Disability Services (SUB I, Rm. 4205; 993-2474; ods.gmu.edu) to determine the accommodations you need; and 2) talk with me to discuss your accommodation needs.

Counseling and Psychological Services: George Mason University has a staff of professional counseling and clinical psychologists, social workers, and counselors who offer a wide range of services (e.g., individual and group counseling, workshops, and outreach programs) to enhance students' personal experience and academic performance. See caps.gmu.edu