Course content: This course is concerned with the study of mind and brain, what is called “cognitive neuroscience”. Cognitive neuroscience is an inter-disciplinary area that represents an attempt by cognitive psychologists and neuroscientists to discover how mental processes are implemented in the brain. The approach focuses on human cognitive and emotional processes and relies heavily on the methods and findings of neuroscience. This is the kind of research that is currently receiving intense coverage in the media, and this course should provide you with a deeper understanding of what you might read and hear about outside of the classroom.

The topics covered are the major ones in “higher-level cognition”, and include: object recognition, conceptual representations (how we represent knowledge), long-term memory, working memory, attention and executive control, emotion, learning, and decision making. To understand the cognitive-neuroscience approach to these topics, students will be introduced to some elementary neuroanatomy, to the logic of studies with neurological and particularly psychiatric patients, and to functional neuroimaging techniques, particularly Positron Emission Tomography (PET), and functional Magnetic Resonance Imaging (fMRI). The goal is to use these techniques, along with behavioral measures, to understand the topics of interest at both a cognitive (or psychological) and neural level.
**Classes:** Classes meet Monday and Wednesday, 10:35 – 11:50am, and consist of lectures and a couple of review sessions. Between 2-4 classes will be devoted to the discussion of a topic (e.g., working memory). The intent is to provide a substantially deeper treatment of each topic than would be available in an introductory-level course.

**Readings:** The readings include (1) chapters from a 2007 textbook, (2) required articles and (3) suggested articles. The textbook is authored by Smith and Kosslyn (hereafter, S&K), and is entitled “Cognitive Psychology: Mind and Brain” (the observant reader may notice a resemblance to the course’s title—no accident). The book is published by Prentice Hall and is available in the Columbia University Bookstore (in Lerner Hall) as well as on the web.

The required articles are sometimes literature reviews, and sometimes original, research papers. The level of these papers is often higher than that of the book chapters. The suggested articles may be even more advanced, and are intended for students who are particularly interested in the topic.


**Exams/Grading:** Grades will depend on four factors: (1) an in-class midterm, scheduled for March 10th, which covers all the material up to that point and is worth 25%; (2) a final, scheduled for Monday, May 10th (from 9:00am – 12:00pm), which covers material from the entire semester but emphasizes the material presented in the second part of the semester, and is worth 50%; (3) a short (6-8pp.) paper on a course topic that you find of particular interest and is worth 15%; and (4) class participation, which is worth 10%. The paper will be due near the end of the semester.

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**SYLLABUS**

Below are listed the intended topic of each lecture, along with the readings for that lecture. Please do the readings before the lecture so that you can understand what is being said in class. (Obviously, Week 1 is an exception.)

NO CLASS ON APRIL 28.

**Week 1**

1/20: Lecture 1  
Introduction to course

**Week 2**

1/25: Lecture 1  
Historical overview and basics of cognitive neuroscience

**Required:** S&K: Chapter 1


1/27: Lecture 2 Percept: How do we recognize objects?

Required: S&K: Chapter 2 (Section 4: “Achieving Visual Recognition”)


Week 3

2/01: Lecture 1

Percept: How do we recognize objects? CONTINUED

2/03: Lecture 2

Percept: Are there specialized brain regions for recognizing faces and places?


Week 4

2/08: Lecture 1

Conceptual representations: How do we represent knowledge?
Required: S&K: Chapter 4


2/10: Lecture 2

*Long-term memory (LTM): Are there different long-term memory systems?*

Required: S&K: Chapter 5


Week 5

2/15: Lecture 1

*Episodic memory: How do we store new episodes?*


VISIT TO fMRI CENTER

Week 6

2/22: Lecture 1  Episodic memory: How do we retrieve old episodes?


2/24: Lecture 2  Episodic memory: Effects of emotion and stress (Teal)

Required: S&K: Chapter 8


Week 7

3/01: Lecture 1  WM: How do we maintain information in an active state?


**3/03: Lecture 2**  
*WM: How do we deal with distraction; how do we manipulate information in WM?*

**Required:**  
S&K: Chapter 6


**Week 8**

**3/08: Lecture 1**  
Review session – no readings

**3/10: Lecture 2**  
MIDTERM

**Week 9**  
(3/15 – 3/19)

**NO CLASS – SPRING BREAK**

**Week 10**

**Suggested:**  
TBD

**3/22: Lecture 1**  
*WM: Breakdowns in psychopathology*

**Required:**  


**3/24: Lecture 2**  
*WM: Breakdowns in normal aging* (Teal)


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**Week 11**

**3/29: Lecture 1**  
*What is the role of dopamine in WM and psychopathology?*


**3/31: Lecture 2**  
*Cognitive Control: Attention and inhibition*

**Required:** S&K: Chapter 7


**Suggested:** S&K: Chapter 3

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**Week 12**

**4/05: Lecture 1  Cognitive Control 2**


**4/07: Lecture 2  Cognitive Control: Breakdowns in psychopathology**


Joorman et al. (in press). Interference resolution in major depression. *Cognitive, Affective, Behavioral Neuroscience.*
**Week 13**

**4/12: Lecture 1**  **Decision making: Rationality?**

**Required:**  S&K: Chapter 9


**4/14: Lecture 2**  **Decision making: Role of emotion**


**Week 14**

**4/19: Lecture 1**  **Decision making: Breakdowns in psychopathology (Maxwell)**

**Required:**  Bechara, A., et al. (1994) Insensitivity to future consequences following damage to human prefrontal cortex. *Cognition, 50*, 7-15.


4/21: Lecture 2  Habit learning: Role of prediction


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**Week 15**

4/26: Lecture 1  Breakdowns of learning and motivation in psychopathology


4/28: Lecture 2  NO CLASS

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**Week 16**

5/03: Lecture 1  Review session – no readings