

CSC9YF: Computing and the Brain**Prerequisites**

CSC9P5

Learning Outcomes

This module will introduce the student to the brain, what we know of its operation and a class of devices, known as artificial neural networks, that are based on brain architecture and function. At the end of the course the student should be able to describe the basic architecture of the brain, the networks of neurons of which it is composed and the operation of neurons. They should be able to contrast the operation of the brain with that of artificial devices such as digital computers and artificial neural networks.

The module will consist of lectures, tutorials, reading and discussion of material and practicals involving learning how to use the computer simulation package, NEURON, to simulate the behaviour of neurons and networks of neurons. The single assignment will consider either realistic or artificial neural networks.

Transferable Skills

- Function and use of artificial neural networks
- Principles of information coding, particularly in the form of discrete spikes or pulses
- Use of simulation package NEURON

Contents

15 lectures – Half Credit

Basic artificial neural networks

- supervised and unsupervised learning.

The levels of brain anatomy

- anatomical regions, columns and nuclei, neurons.

Neuronal operation

- spikes, synapses, and ionic channels

Modelling neurons

- computer simulations using NEURON software

Networks of neurons

- reflex circuits, central pattern generators, architecture of cortex

Coding in neural systems

- rate versus timing codes, population codes

Brains versus computers

- comparison between brains, digital computers and neural networks

Assessment

Assignment 50%, examination 50%

Requirements

In order to obtain a pass grade for the module you must

- Submit all items of assessed coursework
- Attend the examination.

Non-submission of any single item of assessed coursework will result in the award of No Grade for the module as a whole. This rule (regarding coursework) may be relaxed for students who can show good cause for failure to submit. 'Good cause' may include illness (for which a medical certificate or other evidence will be required).

If you are unable to attend the exam, you must apply to the Student Programmes Office for a deferred exam.

Textbooks

Recommended reading:

Fundamentals of Computational Neuroscience, T.P. Trappenberg, 2nd Edition, OUP, 2009*From Computer to Brain*, W.W. Lytton, Springer, 2002.