University of Lincoln Assessment Framework
Assessment Briefing Template 2025-2026

1. Module code & title	CMP9780 Applied Signal and Image Processing
2. Assessed learning outcomes	• [LO1] Critically evaluate and apply the theories, algorithms, techniques and methodologies involved in signal and image processing. • [LO2] Design and implement solutions to a range of signal and image processing applications and problems, and evaluate their effectiveness.
3. Assessment title	Assessment **1**
4. Contribution to final module mark (%)	**50**%
5. Description of assessment task	This is Assessment **1** and is an **individual** assignment. In this assessment, you have been provided with brain EEG signals to process using different digital signal processing (DSP) concepts. This dataset is contained in a zip file located on the Module Blackboard site. The files are in the European Data Format (.edf) and contain brainwave activity, including common artifacts such as seizures, eye blinks, and muscle activity, all sampled at 256 Hz. The sampling frequency can be verified when reading the signal using a Python library like pyedflib. You are required to perform the following analysis on selected samples but verify the results with other samples to ensure your methods work well. 1. **Perform a time-domain and frequency-domain analysis** a) You should plot selected EEG signals in the time domain, which should show amplitude versus time. b) You should also transform the signals used in a. to their frequency domain using Fast Fourier Transform (FFT). c) You should compute and plot the Power Spectral Density (PSD) using appropriate methods like Welch's. d) You should interpret and discuss your plots considering dominant brainwave frequency bands (Delta, Theta, Alpha, Beta). 2. **Further analysis of the sample signals using STFT and CWT, and identify a suitable method for this signal.** a) You should further analyse the selected EEG signal samples using Short-Time Fourier Transform (STFT), and Continuous Wavelet Transform (CWT), and justify the parameters you used for each method. b) You should provide time-domain waveform, frequency-domain representation, and spectrogram visualisations.

c) You should discuss the comparative strengths and weaknesses of FFT, STFT, and CWT in analysing the supplied brain EEG signals, and state the method(s) that is/are most suited for the signals in detecting events with a justification of your choice(s).

3. **Sampling Theorem and Aliasing**
   a) You should downsample the selected brain EEG signals to sampling rates (e.g., 128 Hz, 64 Hz, etc),
   b) Plot and compare the downsampled and original signals to demonstrate the effects of aliasing based on the Nyquist–Shannon sampling theorem, with a step-by-step explanation of this theorem.
4. **Filtering in the frequency domain**
   You should design an IIR or FIR filter that targets frequencies, for example, 1 – 30Hz. Your cutoff frequency must be adjusted appropriately, but a justification for your choices should be given.
5. **Artifact Detection and Characterisation in the EEG Signal**
   You should develop an algorithm to detect blinks, seizures, and muscle artifacts using the hints below or other suitable methodology. You should visualise the detected artifact by marking their onset on EEG plots using different coloured vertical dashed lines with legends colour coded to distinguish between artifact types.

Hints:

1. Seizure usually has high amplitude bursts, which are characterised by rhythmic activity typically in the 6–8 Hz range. Therefore, a bandpass filtering (e.g., Butterworth 6 – 8Hz) followed by amplitude thresholding can be used to detect candidate seizure events.
2. Eye blinks have high-amplitude transient spikes and are usually approximately 100 – 150 ms. They can be detected using amplitude thresholding over short moving windows; any peak above a specified threshold indicates eye blinks.
3. Muscle artifact has high power and may contain high-frequency noise typically in the range 40 – 100Hz. To detect this, you should compute the power spectral density (PSD) and identify segments with increased power.

The Report

You must produce a standard report of up to 5 pages, not including appendices which should cover but not limited to the following:

- How your algorithms or pipeline functionalities work, reflecting on why you chose those approaches.
- You must comment on the tools used and critically evaluate any results from each task.
- You have been provided with a report template to use.

<u>Some other considerations:</u>

- Additional marks will be awarded for originality and scientific rigour.
- Any figures should be numbered and have descriptive legends.
- If you include graphs or tables, be sure to use appropriate axis/column/row labels.

	The Video Demo You must record a 5-minute video of your solution. Because the video is short, you must ensure that just the most essential parts of your solution are captured. **It is critical to note that failing to fulfill the video criteria or submit the video will result in failure mark for this assignment.** Refer to the file "Recording Panapto Video.pdf" for detailed instructions on recording your video. Once completed, upload your video to the Assessment Submission area on Blackboard.
6. Assessment submission instructions	This submission is: Individual work All work should be submitted by the deadline stated. Any late submissions will be subject to a lateness penalty in line with the University policy. In cases of technical issues please email your assessment to: sepssubmissions@lincoln.ac.uk by the above deadline. Please include the module code and coursework title in the email subject. Please note that links will **NOT** be accepted under any circumstances. Your assessment should include a concise report (up to 5 pages – not including Appendices – in PDF format and uploaded to Assessment Item 1 Upload) that describes your work on the above tasks, and a zip file with all the source code, 3-minute video and user generated datasets (uploaded to Assessment Item 1 Supporting Documentation). Other compressed formats (tar.gz, rar, etc.) will **NOT** be accepted, and it is your responsibility to ensure the zip file is not corrupt before submitting. Please note that, in the report, you also need to include the main source codes in the appendix. You must attend the lectures for further details, guidance, and clarifications regarding these instructions. *DO NOT include this briefing document with your submission.*
7. Date for return of mark and feedback	Please see the **Hand In Dates.xls** spreadsheet. Note: *all marks awarded are provisional until confirmed by the Board of Examiners.*
8. Feedback format	Feedback will be provided on Blackboard, along with the assessment mark.
9. Use of Artificial Intelligence (AI) in this assessment	You may NOT use Artificial Intelligence (AI) in this assignment. This means that you may not use any AI technologies including Grammarly, CoPilot, QuillBot and others. If you are not sure whether you should be using a particular tool, then ask your module leader first.
10. Marking criteria for assessment	A Criterion Reference Grid (CRG) is used to evaluate your learning against a set of pre-defined criteria. ***Please note that all work is assessed according to the University of Lincoln Management of Assessment Policy and that marks awarded are provisional on Examination Board decisions which take place at the end of the Academic Year.***
11. Important Information on	University of Lincoln Regulations define plagiarism as *'the passing off of another person's thoughts, ideas, writings or images as one's own...*'. Examples of plagiarism include the unacknowledged use of another person's material

Dishonesty, Plagiarism and AI Tools	whether in original or summary form. Plagiarism also includes the copying of another student's work'. Plagiarism is a serious offence and is treated by the University as a form of academic dishonesty. For more information on examples of Academic Offences, please see the **Academic Offence Guidance**. The use of AI tools: Not Permitted Please note, if you use AI tools in the production of assessment work **where it is not permitted**, then it will be classed as an academic offence and treated by the University as a form of academic dishonesty. Students are directed to the University Regulations for details of the procedures and penalties involved. For further information, see www.plagiarism.org