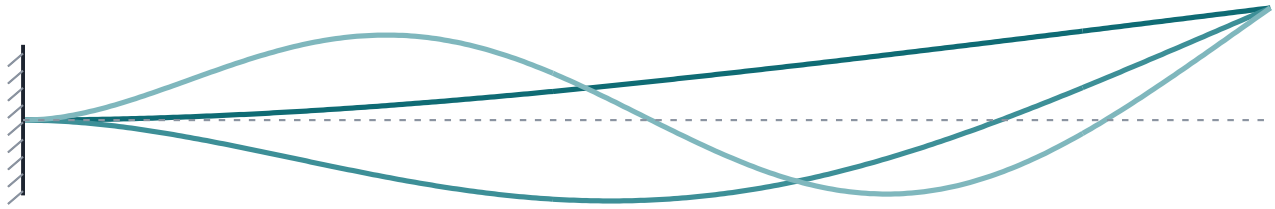
MECH3200 · ADVANCED DYNAMICS & VIBRATIONS

Exam Sheet Guide

What to put on your one handwritten A4 sheet, why each line earns its space, what to leave off, and a tested layout for both sides.



Built for: the current course (listed as Engineering Dynamics 2 from 2026, same code), final exam 50%, 180 minutes, closed book with one handwritten A4 sheet, 40% hurdle

Organised by: the question types that come back every year, so the sheet supports how you will actually use it in the room

Every constant and check value: re-computed in Python (NumPy and SciPy)

Written by: a UQ mechatronics engineering graduate who took MECH3200 and tutored first-year engineering at UQ

Independent study notes. Not affiliated with or endorsed by The University of Queensland. All wording and diagrams are original. Exam rules are from the public course profile and can change, so check yours before you write your sheet.

The rules, and how the paper works

Your sheet is the only thing you bring in besides a calculator. Get the rules right first, because a sheet that breaks them can be taken off you at the door.

Exam at a glance (current course profile)

What	Detail
Weight	50% of the course
Time	10 minutes planning plus 180 minutes writing, on paper, in person
Your sheet	One A4 sheet of **handwritten** notes, both sides. Notes handwritten on a tablet and printed count as handwritten. Typed notes do not.
Calculator	Casio FX82 series, or a UQ approved and labelled calculator
Hurdle	Under 40% on the final caps your grade at 3, whatever your assignments
Grade cut-offs	4 at 50%, 5 at 65%, 6 at 75%, 7 at 85% overall

How the paper has been built

Recent finals have followed a steady pattern of five 20-mark questions, roughly 36 minutes each:

Block	What it asks	What your sheet must support
Discrete, concepts	Multiple choice on modal analysis, damped eigenvalues, absorbers and isolators	The true/false facts: bounds, what damping does, what is diagonal when
Discrete, long	Lagrange to matrices, frequencies, modes, modal mass, then a forced or damped response	Energy terms, modal recipes, damping formulas
Measurement and applications	Short answers and multiple choice on hammers, shakers, transducers, signal processing, nonlinear effects, isolation	A compact facts list (this is where people run out of space)
Continuous, concepts	Multiple choice on strings, rods, beams, added masses, Rayleigh, Dunkerley, Holzer, FE	Wave speeds, boundary conditions, method comparisons
Continuous, long	String and beam frequencies, mode-shape sketches, a forced beam, an approximate estimate	Frequency formulas, βL values (if no table is supplied), forced-beam recipe

The split and style can change from year to year. Treat the pattern as a guide to where the marks have been, and check the current course page for any notice about the exam format.

How to use this guide

1. Read each section. The grey **Write this** boxes are the content, shown the way it fits on a sheet: dense, no prose.
2. The line under each box says **why** it earns space. If you already know a line cold, leave it off and use the space elsewhere.
3. The yellow **Leave off** boxes list things that waste space.
4. Section 10 gives a layout for both sides with the share of space each block gets.

What earns a place on the sheet

An A4 sheet holds a lot less than you think once it is handwritten small enough to fit. Five rules decide what goes on.

1. **Write what you cannot rebuild in two minutes.** Lagrange's equation you can write from memory. The general absorber formula with β, you cannot. The second one gets the space.
2. **Write recipes as numbered steps.** Under time pressure a five-step recipe beats a derivation. The long questions are recipes with numbers.
3. **Write the trap next to the formula.** "$y_i(0)$ needs M" beside the projection formula saves more marks than another formula would.
4. **Do not copy what the paper gives you.** Past papers have printed a beam mode-shape table at the back. If yours does, a few βL values are all you need as a backup.
5. **Add check values.** A handful of known answers (cantilever 3.516, string ratios $1:2:3$) let you catch a slip before it costs every later part.

THE BIG MISTAKE

Copying the lecture notes in tiny writing. You will not find anything in it under pressure, and most of it you already know. A sheet made of recipes, traps and check values beats a sheet of copied derivations every time.

1 Lagrange and building M, C, K

WRITE THIS

$$\frac{d}{dt}\frac{\partial T}{\partial \dot{q}_i} - \frac{\partial T}{\partial q_i} + \frac{\partial V}{\partial q_i} + \frac{\partial D}{\partial \dot{q}_i} = Q_i$$

$T = \sum \tfrac{1}{2} m \dot{x}^2 + \sum \tfrac{1}{2} J_G \dot{\theta}^2$ · $V = \sum \tfrac{1}{2} k (\text{stretch})^2$ · $D = \sum \tfrac{1}{2} c (\text{stretch rate})^2$ · pendulum $V \approx \tfrac{1}{2} m g L \theta^2$

WRITE THE STRETCH FIRST. M, K symmetric, K diagonal positive.

Springs: parallel $k_1 + k_2$; series $(1/k_1 + 1/k_2)^{-1}$. Gears ratio n (load slower): refer to motor side J_L/n^2, k_L/n^2.

Rigid bar on 2 springs (front a, rear b): $K_{12} = k_1 a - k_2 b$; decoupled if $k_1 a = k_2 b$.

WHY: Lagrange itself is easy to remember, but the gear factor and the bounce-pitch coupling term are the bits people get backwards. The stretch rule prevents the most expensive slip in the long question.

LEAVE OFF

Full derivations of Lagrange's equation. Worked examples from lectures (you need the method, not their numbers).