VIBRATIONS AND ACOUSTICS

Organization of the second session. Academic Year 2019-2020. Prof A. Deraemaeker

GENERAL ORGANISATION

In accordance to the rules of our Faculty, the second session evaluations will be organized remotely only via TEAMS.

1. The students who passed the MCQ exam and were admitted to the oral examination and project presentation, are allowed to keep their grade for the MCQ. The weight of the different evaluations remains the same as in the first session, but the oral examination is split in two parts, each worth 30% of the final grade:

   - MCQ 1st session : 20% / Project : 20 % / Oral Acoustics : 30% / Oral Vibrations : 30%

2. For the students who were not admitted to the oral examination or who wish to redo the content of the MCQ, the weights are as follows

   Project : 20 % / Oral Acoustics : 40% (of which 10% related to basics) / Oral Vibrations : 40% (of which 10% related to basics)

   If you had more than 14/20 at the MCQ in the first session, you have to tell the professor on the day of the oral examination if you wish to keep your grade or not.

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ORGANISATION OF THE ORAL EXAMINATION OF VIBRATIONS (Prof A. Deraemaeker)

The oral examination will consist in the two following parts:

PART I (only for the students who were not allowed to the oral examination in the first session, or who wish to be interrogated again on the basics of vibrations)

This part will consist in short questions related to the basic theory, which you have to answer instantaneously without any preparation. For these questions, you are expected to know the fundamentals of vibrations on the following topics (same as first session):

- The type and nature of excitation forces in vibrations
- What is harmonic motion, what is the meaning of complex amplitudes
- The mechanism of vibrations, what is resonance and what do the resonant frequencies depend on?
- The response of a single degree of freedom system with and without damping, both in the time domain and in the frequency domain, and the effect of damping. How do you read a Bode diagram? What is the physical meaning of an impulse response and what is its use in vibrations?
• What is the Fourier transform and the difference between the discrete and continuous Fourier transform? What is it used for in applications related to vibrations?
• Fourier transform of sampled signals: what is the effect of the different parameters (length of signal, time sampling), what is aliasing, what are windowing functions, and which should be used for which type of signals.
• What are mode shapes and what is the advantage of projection of the equations of motion on the modal basis. Why is the orthogonality of mode shapes important?
• What are the Rayleigh and the modal damping models? How are they related? What is hysteretic damping?
• What is modal truncation and how to decide on the number of modes to consider for a given application?
• What is low and high tuning?
• What are the main principles to reduce a model to a 1dof system with equivalent mass and stiffness?
• Order of magnitude of damping coefficients in civil engineering structures
• Working principle of a TMD (principles of design)
• Working principle of a direct/inverse isolation device (principles of design)
• Working principle of an accelerometer and a geophone.

This part is worth 10% of the final grade

PART II

The second part will consist in the presentation of one of the 5 case studies (part related to vibration aspects only), and will be organized as follows:

• Before the examination day, you are expected to prepare electric documents (which can be a scan of hand-written material, copy of the slides of the course, your own pdf, ppt ...) to serve as a support for the presentation of the 5 case studies.
• At the time of your examination, a random number from 1 to 5 will be drawn and you will have 5 minutes to review your notes on the assigned case study. The presentation of the case study will be done by sharing the document on your screen. It will last 10-15 mins, and you can be interrupted at any time for questions by the professor

This part is worth 30% of the final grade

SCHEDULE

The schedule will be established once the dates of the oral examination are known. It will be established separately for the vibrations and the acoustics part (for which Prof Migeot will send the practical details of the organization of the oral evaluation in a separate email).