List of possible questions concerning Riverbed forms, regimes and stability

It will be generically assumed that the key concepts related to hydraulics and incipient motion conditions are known

- Explain the supply-limited and the capacity-limited transport concepts;
- Explain the effective discharge affecting sediment transport capacity;
- Illustrate the different type of small-scale bedforms and their formation conditions;
- Write down the three main equations governing a 1D (x,t) morphodynanic problem;
- Use the Exner equation and the Fourier mode expansion to obtain the domain where the real part of the celerity is positive as a function of the phase shift δ;
- Explain the three characteristic regimes foreseen by the 1-D model expansion;
- Describe the main geometrical characteristics of Ripples and the formation domain (one preferred theory)
- **Exercise**: given flow parameters and a stability plot, determine the expected wavelength and amplitude of ripples;
- Describe the main geometrical characteristics of Dune;
- Explain the phenomenological process leading to the formation of dunes;
- **Exercise**: given flow parameters and a stability plot, determine the expected wavelength and amplitude of dunes;
- Explain the characetristics and domain of antidunes;
- Explain the phenomenological process leading to the formation of alternate river bars (1-n modes);
- Explain either the Einstein or the Engelung and Hansen formulations for bedforms resistance to flow
- **Exercise**: Given flow conditions compute the expected friction factor using Van Rijn method (formulas given)

STABILITY AND REGIME

- List and define the condition under which different fluvial styles form;
- Explain the concept of dynamic equilibrium in nature;
- Explain the stability concept using the qualitative Lane's equation;
- Write down the main relationships linking slope, river width and water depth for narrowing and widening reaches at equilibiurm;
- Explain the expected equilibrium conditions affecting riverbed and water surface elevation for widening and narrowing conditions at equilibrim;
- Write down the main expressions concerning the regime theory and explain their physical meaning;
- **Exercise**: given flow rate changes at two sections determine the expected changes of other hydrualic and geometric quantities;
- Explain river meandering dynamics at both the short and the long term;
- **Exercise**: given characteristic flow conditions, determine the average geometrical quantities of the meandering reach and the expected meander belt width with a given confidence interval (plot provided)
- Describe the effect of embankment on free migrating meanders;
- Describe the effect of regulation on vegetated braided rivers;
- Explain the "Room for rivers" concept