

# AESB2230 Sedimentology&Reservoir Geology Theory Exam

29 January 2018 – Hemmo A. Abels

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Name:

Student number:

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Please give a concise answer to the open questions, less but correct words are better than more vague or incorrect words. When drawings are needed, do not forget a scale, labels and legends, and explanation. You get 2pts per question unless otherwise indicated, 70 pts in total.

Good luck!

## Fan Systems (10 pts)

1a. Fans occur as alluvial fans, and in deltas and deep marine settings. What are their similarities in shape and morphology?

1b. Name two differences between three different types of alluvial fans?

1c. Which two main parameters control the differences between alluvial fan styles?

1d. How can one distinguish a deep marine fan from an alluvial fan in a sediment core?

1e. Channel lobe switching in a fan is controlled by what parameters? Name three.

## Fluvial Systems (16 pts)

2a. What parameters control channel style between meandering, anastomosing and braided rivers?

2b. What is an oxbow lake and how is it formed?

2c. Make a drawing of the formation of an oxbow lake in two time steps.

2d. Draw a cross section perpendicular to flow in the bend of a meandering river. Include water flow direction and strength and where deposition and erosion takes place. (3pts)

2e. If stratigraphy builds up in the centre of the channel over time, draw the vertical succession of sediments when the whole channel meander passed over it. Highlight grain size of the sediment and give a Gamma Ray log next to it (3 pts).

2f. What parameters control river avulsion at long-term time scales?

2g. How does sedimentation rate controls the distribution of channel belts in alluvial architecture?

**Coastal systems (15 pts)**

- 3a. Draw a simple Hjüllstrom diagram
- 3b. On your diagram of question 3a, indicate using an arrow what happens with the water and sediment during the deposition of a delta mouth bar.
- 3c. Which three delta type end-members exist?
- 3d. For one of the three types in 3c, give at least four characteristics about shape, size, coastal profile, and sediment.
- 3e. Draw a coastal profile from the delta plain to the offshore shelf at a single moment in time and name the components below it.
- 3f. Draw in the answer of 3e the subsequent accumulated profile after the system prograded, retrograded, and aggraded. (3pts)
- 3g. What is sequence stratigraphy and what can it be used for?

**Sediment transport (15 pts)**

- 4a. What is the name of the force causing the lifting of particles in flowing water? *uplift*
- 4b. What three types of transport modes exist in flowing water?
- 4c. Explain the reason(s) for the starting of ripple formation as bed form in flowing water.
- 4d. What factors control the formation of ripples and parallel bed forms in flowing water?
- 4e. How can you distinguish lower stage plane bed forms from upper stage plane bed forms?
- 4f. The Bouma sequence shows a striking order of sediments. Explain the sequence in terms of energy and grain size down the slope (3 pts)
- 4g. Describe the resulting sediments of a debris flow in terms of grain size and sorting and down-stream change.

**Applied Sedimentology (14 pts)**

- 5a. In the subsurface, applied earth scientific problems may need sedimentary knowledge. Explain why.
- 5b. The representative elementary volume (REV) is important when dealing with problems and with data potentially solving a problem. Explain why.
- 5c. Which types of sedimentological research methods are used to produce more accurate geological predictions of subsurface character?
- 5d. Name a laterally very consistent depositional environment and one that is laterally very heterogeneous.
- 5e. Name three controlling parameters on vertical variability of sediments.
- 5e. What predicts Walther's Law?
- 5f. Name three geological sub-disciplines needed for integrated geological analysis of a geological outcrop.