Typical questions to be asked in examination

As I have stated elsewhere, there will be little mathematics or calculation on the examination.

- There will be questions like "Write a short essay, possibly in bullet point form and possibly without mathematics, on ...". Even if not stated below, ("Discuss ...") that is the guiding principle you can use.
- The tutorial sheets that ask for descriptions are a good guide.
- Can you explain briefly how this relation was obtained, and what it means:

$$\overline{u^2} = \bar{u}^2 + \overline{u'^2}.$$

- What is the difference between Bernoulli's equation and the energy conservation equation in integral form (as described in our lecture notes – many people make no distinction in the naming).
- Discuss the concept and use of resistance in open channel flow.
- Discuss the concept of wetted perimeter in open channel flow equations.
- In the long wave equations, which are generally for non-uniform, time varying flow, to compute the local resistance, just the local flow velocity and channel geometry are used. Why is this a good approximation?
- In steady sub-critical river flow, what is the effect of an obstacle such as a bridge pier on the flow (a) downstream and (b) upstream of the bridge?
- Describe the way in which a detention reservoir operates so as to reduce the maximum discharge downstream.
- Here are the long wave equations in terms of cross-sectional area A and discharge Q:

$$\frac{\partial A}{\partial t} + \frac{\partial Q}{\partial x} = i,$$
$$\frac{\partial Q}{\partial t} + \frac{\partial}{\partial x}\left(\beta \frac{Q^2}{A}\right) + \frac{gA}{B}\frac{\partial A}{\partial x} = gA\tilde{S} - \Omega Q\left|Q\right|.$$

  Explain the physical significance of each term in each equation.
- Can you explain why the long wave speed c_0 at which flood waves travel (to first approximation) is greater than U, the mean speed of the water in the river? (In fact, $c_0 \approx \frac{5}{3}U$)?
- Consider the *Advection-diffusion equation*, which is a good approximation to flood motion:

$$\frac{\partial v}{\partial t} + c_0\frac{\partial v}{\partial x} - \frac{Q_0}{2B_0 S}\frac{\partial^2 v}{\partial x^2} = 0.$$

  What is the effect of the term with the second derivative?
- The bridge mentioned earlier causes the water to rise $30\ \mathrm{cm}$ above the level that would exist without the bridge, in water of depth $1.5\ \mathrm{m}$. How might you calculate the upstream effects of the bridge?
- Describe how the discharge in a stream is measured and calculated with the aid of a current meter.
- Describe the concept and use of a Rating Curve, relating the discharge in a stream to the water level. If you can, describe any problems that that method has.
- Gradually over time, an "armour layer" builds on the bed of a stream, where individual particles are removed and the spaces between bed particles become filled with smaller particles. The bed becomes smoother. What would be the effect on the discharge calculated for a given water level?
- Give an example of something you liked about the *content* of this subject and/or agreed with.
- Give an example of something you did not like about the *content* of this subject and/or *disagreed* with.