**Course 9, “Retention & Retention Aids in Papermaking,” Final Quiz**

**Complete the following form and take the quiz to receive a certificate of course completion. Please enter your information in the way you would like it to appear on your certificate. Send your completed form (in WORD or PDF format) as an email attachment to hubbe@ncsu.edu.**

**Your full name (print carefully or type):**

**Your affiliation (school, company, etc.):**

**Your email address:**

**Having taken this course will help me to…**

**This course could be improved by…**

**My idea for a future course in this series would be…**

FINAL QUIZ FOR COURSE 9 (ten questions)

1 – What part of the papermaking system has the highest ratio of fines to fibers?

1. Thick stock before the fan pump
2. Thin stock after the fan pump
3. The paper web after the forming section
4. None – equal ratio throughout the process

2 – What type of additive for papermaking ordinarily has a very high molecular mass (typically 5 to 20 million grams per mole)?

1. High-charge polyamine (scavenger)
2. Poly-ethylene imine (PEI, branched type)
3. Polyvinylamine (after hydrolysis of amide groups)
4. Acrylamide copolymer retention aid

3 – Which of the following retention aids has little effect when added to a papermaking system where there is no alum or cationic starch, *etc*.?

1. Cationic acrylamide copolymer
2. Poly(dimethylamine epichlorohydrin)
3. Anionic acrylamide copolymer
4. Cationic starch

4 – Of the following, which unit operation on a paper machine is expected to have the highest hydrodynamic shear, based on published estimates (Tam Doo *et al.* 1984)?

* Rectifier roll
* Pressure screen
* Headbox slice
* Hydrofoils

5 – What can be done to minimize the amount of low- to medium-mass cationic polymer that diffuses into the cell walls of kraft fibers?

1. Addition relatively late in the process, *e.g.* before or after the fan pump
2. Addition in highly diluted form so that the water helps to resist the diffusion
3. Addition at low temperature, to increase the viscosity and slow diffusion
4. Injection using a venturi system (an educator)

6 – What can users of lab tests, such as the Britt jar, do in order to “calibrate” the results with a paper machine system?

1. Adjust the length of time of shearing in the lab test to match the results obtained on the paper machine.
2. Adjust the stock consistency of the lab test to match the results obtained on the paper machine.
3. Adjust the hydrodynamic shear of the lab test to match the results obtained on the paper machine.
4. Adjust the polymer dosage of the lab test to match the results obtained on the paper machine.

7 – Which type of micro- or nano-particle, useful in retention and drainage additive programs, has a highly platy shape with a thickness in the nano-scale?

1. Colloidal silica (sol type)
2. Colloidal silica (gel type)
3. Bentonite (montmorillonite)
4. Micropolymer (crosslinked)

8 – What type of colloidal silica, in combination with a cationic retention aid (acrylamide copolymer), can be expected to be most effective for increasing fine-particle retention?

1. High-structure (sol-type)
2. High-structure (gel-type)
3. Low-structure (gel-type)
4. Low-structure (sol-type)

9 – In what way did the addition of extractives to papermaking furnish affect the performance of a retention system with cationic starch and colloidal silica?

1. Excessive flocculation, leading to poor uniformity of the resulting paper
2. Foaming occurred due to the surface-active nature of the extractives, in combination with the starch and silica
3. Lack of increase of fines retention, especially at low cationic starch levels
4. High retention efficiency due to a synergic interaction between the colloidal silica and the extractives

10 – Why is an increased proportion of coated broke often highly correlated with changes in charge demand and in the required dosage of retention aid needed to maintain a steady level of fine-particle retention?

1. The broke contains high levels of wood extractives from the coating.
2. The broke contains high levels of oxidized hemicellulose from bleaching.
3. The broke contains high levels of silicates and fatty acid soaps.
4. The broke contains negatively charged latex and pigment dispersants.