**Course 6: “Water Removal & Productivity on the Paper Machine, 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):**

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**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 6 (ten questions)

1 – Which of the following chemical substances is NOT expected to contribute to faster dewatering during the formation of paper?

1. Aluminum sulfate (papermaker’s alum)
2. Cellulase (enzyme)
3. Bentonite (or colloidal silica) in sequence with a cationic polymer
4. Low-mass poly(acrylic acid-co-acrylamide) (dispersant)

2 – Which of the following mechanisms of retention of fine particles onto fiber surfaces is maximized when surfaces are about half-covered and half-uncovered by cationic polymer?

1. Charged patch mechanism
2. Polymer bridging mechanism
3. Mechanical binding mechanism
4. Nanoparticle / cPAM mechanism

3 – What is the expected effect of increased refining on the rate of water removal during the formation of paper?

1. Increased refining results in faster dewatering.
2. Increased refining results in slower dewatering.
3. Increased refining does not affect dewatering.
4. More information is needed to answer the question.

4 – About how big is the minimum dimension (thickness or diameter) of a typical particle of bentonite (sodium montmorillonite) or colloidal silica used in papermaking?

1. 2 to 20 nm
2. 100 to 400 nm
3. 1 to 2 micrometers
4. 0.1 to 1.5 mm

5 – Which of the following is often true at the point of optimization of a drainage and retention program that involves a high-mass cationic polymer and sequential addition of a micro- or nanoparticles such as bentonite or colloidal silica?

1. Minimum value of Canadian Standard Freeness
2. A pH value of about 4.2
3. Zeta potential near to zero
4. A minimum of first-pass retention

6 – What molecular attribute of a high-charge cationic polymer drainage aid can be expected to make it more effective (bigger increase in drainage rate at lower dosage)?

1. Lower molecular mass
2. Higher molecular mass
3. Linear molecular structure
4. A high level of crosslinking

7 – At what point in a typical papermaking process, using kraft pulp, should a cellulase enzyme be applied when the main goal is to achieve faster drainage while keeping paper properties about the same?

1. After the refining of the fibers
2. Before the refining of the fibers
3. Sprayed onto the wet web in the Fourdrinier section
4. Just before the headbox to minimize time of contact with the fibers

8 – What is a practical way to convert an over-flocculated suspension of papermaking fibers into a mixture that would provide favorable dewatering both in the “early” (hydrofoils) part of a Fourdrinier paper machine and “late” (vacuum boxes) dewatering?

1. Add nanoparticles to the overflocculated suspension.
2. Add a high-charge cationic polymer before the other additives.
3. Apply hydrodynamic shear to the overflocculated suspension.
4. Use the mixture very quickly before the polymer bridges can form.

9 – What property of water itself can explain why wet-press performance can be improved by use of a steam box or a heated press roll?

1. The diffusion rate of water molecules increases with increasing temperature.
2. The treatments remove air content from the water, which promotes water release.
3. The water becomes supercritical, which dramatically changes its behavior.
4. Water’s viscosity decreases when it is heated.

10 – What happens, in general, to the rate of water release from paper in a conventional set of steam-heated dryer cans after there is no longer a film of water that extends out as far as the paper surface?

1. The rate of evaporation increases after that point.
2. The rate of evaporation stays constant after that point.
3. The paper begins its “warm-up period” at that point.
4. The rate of evaporation falls after that point.