**OPTIONAL QUIZ QUESTIONS for Course 12: “Size Press”**

Session 1: Introduction: Why use a size press?”

1A – To maximize stiffness, what idealized structure represents what parts of the paper sheet ought to be made stronger?

* Tonge & groove
* Brick-wall
* I-beam
* Rebar

1B – If the goal is to maintain a constant rate of production, what part of the paper machine usually needs to be increased by over 20% if a size press is being installed for the first time?

* The wet end operations
* The forming section
* The wet-press section
* The dryer section

1C – What problem related to offset printing is often reduced when a size press is being used?

* Contamination of fountain solution, ink, *etc.* by particles
* Build-up of viscosity of the inks (especially yellow)
* Excessively high print density
* Feathering of the process color images

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Session 2: Size press equipment

2A – What do you call a pond-type size press in which the path of the paper through the nip is vertical?

* Horizontal flooded nip
* Inclined flooded nip
* Vertical flooded nip
* Film press

2B – Compared to a flooded nip (pond-type) size press, what key advantages are achieved when using a film press and running with a higher solids and lower contact time before the nip?

* Completely non-porous film of starch
* Stronger bonding with the fibers of the paper
* Deeper penetration of formulation into the paper
* Reduced size press breaks of the web

2C – What part of starch uptake at a size press is not affected by “wetting delay”?

* Transfer to valleys of surface roughness
* Transfer into pores within the paper sheet
* The part that exceeds the repulsive capillary forces
* The incompressible part

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Session 3: Starch basics

3A – What is the branched form of starch called?

* Amylose
* Amylopectin
* Crosslinked
* Converted

3B – An individual molecule of starch dissolved in water takes on what form?

* Helical
* Fibrillar
* Globular
* Micellar

3C – What synthetic polymer has been used at the size press for specialty operations requiring high film strength and stability of the solution?

* Guar
* Chitosan
* Alkylketene dimer
* Polyvinyl alcohol

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Session 4: Size press operations

4A – Why is it necessary to reduce the viscosity of starch in order to run the formulation on a modern size press?

* So that the viscosity will then remain stable
* To flow smoothly at shear points and in the nip
* To prevent the formation of filaments
* To allow the starch to be cooked successfully

4B – What type of bonds within starch are broken by an amylase enzyme?

* Glycosidic
* Carbon-to-carbon
* Ester
* Hydrogen

4C – What is the cause of mist formation at the exit of a size press nip?

* Evaporation and condensation in the high-humidity zone adjacent to the size press
* Cavitation due to bubble implosion after the point of maximum vacuum as the nip opens
* Nebulization due to tiny-amplitude vibrations at the size press nip
* Stretching of filaments and their breakage into droplets due to capillary instability

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Session 5: Hold-out of starch at the size press

5A – The Lucas-Washburn equation is based on what kind of model of porosity?

* Cylindrical pores
* Packed spheres in a bed
* Styrofoam elbows
* Random fibers

5B – For what reason is AKD (alkylketene dimer) sometimes not the best choice of a wet-end (internal) sizing agent to be used on a paper machine with a size press?

* AKD may react with the size press starch.
* Curing of AKD is often incomplete at the size press.
* Rewetting at the size press causes the AKD to disengage.
* Cooling of the web by the size press formulation interferes with AKD sizing.

5C – Why does one of the crystal faces of cellulose tend to be more hydrophobic?

* There is a lack of hydrophilic -OH groups pointed in that direction.
* There is a balance of positive and negative charges in that direction.
* Inclusion complexes for hydrophobic monomers are formed by V-type amylose helices.
* Long contact with water causes those surfaces to reorient and become hydrophobic.

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Session 6: Hydrophobic copolymers at the size press

6A – Which of the following is a true statement about copolymers used at the size press for the purpose of making the paper more hydrophobic?

* The copolymer includes both hydrophilic and hydrophobic parts.
* The copolymer is completely hydrophilic.
* The copolymer is completely hydrophobic.
* The copolymer is hydrophilic in solution but becomes hydrophobic when attached.

6B – The hydrophobic copolymers used at the size press are most likely in what form when they are well mixed with water under ideal conditions?

* Emulsion droplets
* Foam bubbles
* Vesicles
* Micelles

6C – What kinds of molecules are often stabilized within V-type amylose helices?

* Hemicellulose macromolecules
* Resin acids, from pine pitch
* Chains of sodium atoms
* Fatty acid monomers

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Session 7: Troubleshooting

7A – What property of a starch solution can be determined by a device that measures the bending of light in a prism system?

* Solids
* Turbidity
* Optical activity
* Precipitation from solution

7B – Of the following, what condition is expected to lead to the most serious misting problems?

* Low take-off angle
* High take-off angle
* Zero take-off angle
* Equal misting on both sides

7C – What do the terms “retrogradation” and “set back” mean?

* Precipitation of starch from solution
* Return to a less mature form of the starch, i.e. amylose
* Conversion of part of the starch into its component sugars
* Conversion of single-coil helices to double-coil helices

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Session 8: Paper product enhancements at the size press

8A – What type of colorant should generally not be used at the size press, when the goal is to achieve even coloration?

* A high-affinity dye, such as cationic direct
* A moderate-affinity dye, such as a direct dye
* A low-affinity dye, such as an acid dye
* A black dye, such as a fine carbon black dispersion

8B – Optimized platy mineral particles in a size press formulation are expected to have what kind of effect on the results of size press application?

* Less permeation of the size press formulation
* More permeation of the size press formulation
* High gloss due to alignment of the particles in the calenders
* Increased friction due to particle edges protruding at the surface

8C – What is one reason why the usage of nanocellulose at a size press can be expected to be challenging?

* Nanocellulose always tends to form rainbow colors.
* Nanocellulose tends to nucleate retrogradation.
* Nanocellulose is incompatible with starch solutions.
* Nanocellulose increases the viscosity of the mixture.

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ANSWERS TO QUIZ QUESTIONS, COURSE 12

1A: I-beam

1B: The dryer section

1C: Contamination of fountain solution, ink, *etc.* by particles

2A: Horizontal flooded nip

2B: Reduced size press breaks of the web

2C: Transfer to valleys of surface roughness

3A: Amylopectin

3B: Helical

3C: Polyvinyl alcohol

4A: To flow smoothly at shear points and in the nip

4B: Glycosidic

4C: Stretching of filaments and their breakage into droplets due to capillary instability

5A: Cylindrical pores

5B: Curing of AKD is often incomplete at the size press.

5C: There is a lack of hydrophilic -OH groups pointed in that direction.

6A: The copolymer includes both hydrophilic and hydrophobic parts.

6B: Micelles

6C: Fatty acid monomers

7A: Solids

7B: High take-off angle

7C: Precipitation of starch from solution

8A: A high-affinity dye, such as cationic direct

8B: Less permeation of the size press formulation

8C: Nanocellulose increases the viscosity of the mixture.