

## Department of Forest Products Technology

### PUU-28.4060 ADVANCED BIOCOMPOSITES

*Examination date 13<sup>th</sup> May 2009*

1. Briefly describe the following terms (please use a diagram if necessary) (8 marks)
  - i. Toughness
  - ii. Yield point
  - iii. Resin injection moulding
  - iv. Extrusion
  - v. Work of fracture
  - vi. Interphase
  - vii. Fibre aspect ratio
  - viii. Multi axial fabrics
  
2. Answer the following (provide formulae where appropriate): (12 marks)
  - i. What is meant by the terms “stress transfer” and “load sharing”?
  - ii. Explain the pultrusion process
  - iii. What is meant by “fibre volume fraction”?
  - iv. Define the “Rule of Mixtures” and give one example of how it can be used to predict the properties of a composite
  
3. Explain why some composites have high toughness, even though the materials making up the composite are brittle (e.g. glass fibre reinforced thermosetting polymer matrix composites) (8 marks)
  
4. Answer both parts: (12 marks)
  - i. Explain why high aspect ratio fibres provide more effective reinforcement than very short fibre or particles (you may wish to use a diagram to support your description).
  - ii. A polymer matrix composite is reinforced with unidirectionally aligned long fibre (i.e. all fibres are aligned in the same direction, parallel to the composite axis). If the fibre volume fraction is 0,5 (50%), the fibre axial Young’s modulus is 80 GPa and the matrix modulus is 4 GPa, calculate the theoretical Young’s modulus of the composite.
  - iii. What might be the effect (or effects) of defects in the structure of natural fibres on the properties of composites reinforced with these fibres?
  
5. Write an essay on one of the following: (10 marks)
  - i. Natural fibres as reinforcement in composites
  - ii. The influence of fibre architecture on the mechanical properties of composites
  - iii. Renewable resource-based polymers as matrices for biocomposites materials.