

ACMA6000 Coursework Feedback

Student	Luke John
Student ID	2320124
Assessment	Manufacture of Wind Turbine Blade
Final mark	85 / 100

1. Engagement with Literature Skills — 17/20

The report demonstrates a strong independent literature base covering aerodynamic design, environmental loading, material selection, blade manufacture, structural mechanics and production cost. Sources include recognised textbooks, peer-reviewed journal papers, ORE Catapult material, Met Office data and recent composite-manufacturing research. Literature is frequently used to justify actual engineering decisions rather than merely provide background. Examples include the Milford Haven wind-speed input, BEM assumptions, selection of NACA profiles, ceramic screening, shell-thickness assumption, LRTM comparison and torsional methodology. The manufacturing literature is particularly well integrated because quantitative process improvements are carried directly into the LRTM decision. The mark is limited slightly by some weaker web-based sources and inconsistencies in bibliographic quality alongside the stronger academic references.

2. Knowledge and Understanding Skills — 24/30

The submission demonstrates very strong understanding of blade aerodynamics, materials, manufacturing and structural mechanics. The design starts from a specific energy requirement and independently sourced local wind speed, producing a 24.72 m blade. Simplified BEM is then used to calculate local tip-speed ratio, flow angle, force coefficient, solidity, chord and twist rather than simply assigning these quantities. The student also makes an independently justified aerodynamic choice to vary the blade from NACA 4412 at the root through progressively thinner NACA 44-series profiles towards the tip, explaining the intended aerodynamic and structural rationale. This is accepted positively because the alternative is explained and applied consistently. Material understanding is also strong, particularly fatigue, specific performance and composite behaviour. The main limitation is that although metals, ceramics and composites are discussed and ceramics are explicitly screened out for justified reasons, the manufacturing section itself develops VARTM and LRTM in substantially more detail than equivalent metal and ceramic manufacturing routes.

3. Cognitive and Intellectual Skills — 17/20

There is strong evidence of independent engineering judgement. The student uses Granta screening followed by a properly weighted decision matrix, with fatigue receiving the greatest emphasis and carbon fibre/epoxy ranking highest. The final recommendation recognises carbon fibre's cost and end-of-life disadvantages rather than ignoring them. Manufacturing selection is also particularly analytical: LRTM is chosen over VARTM using quantified evidence for infusion time, dimensional accuracy, void formation, resin waste and potential cost improvement. The structural analysis is interpreted critically rather than simply reported; the very high factors of safety are recognised as evidence that the solid preliminary model is over-conservative and could be optimised toward a hollow design. A higher mark would require that optimisation to be actually completed and recalculated.

4. Practical Application Skills — 19/20

This is an exceptionally strong practical submission. The work contains a complete engineering chain from energy requirement and blade sizing through BEM geometry, five calculated airfoil sections, Excel-generated NACA coordinates, CAD, material selection, design-specific cost calculations, aerodynamic forces, bending, torsion and factors of safety. Section properties are not simply assumed: centroid, second moment of area and maximum fibre distance are determined numerically from the actual NACA-coordinate geometry. Lift and drag are calculated at each section using relative wind velocity, and the resulting blade loads are carried through to bending stresses. Torsional loading is also explicitly developed using aerodynamic-centre offset

and Saint-Venant torsion. The CAD requirement is fully satisfied through the 3D blade model and individually dimensioned spanwise sections; no internal blade CAD is required. The only significant limitation is the inconsistency between the solid structural model and hollow cost model, together with the simplifications necessarily used in the preliminary stress calculation.

5. Transferable Skills for Life and Professional Practice — 8/10

The report is comprehensive, well organised and technically easy to navigate. It includes a clear abstract, contents, figure list, structured technical sections, appendices, Granta evidence, Excel calculations, CAD models and a final comparative table. The comparative analysis effectively integrates strength-to-weight ratio, fatigue, density, manufacturing compatibility, scalability, recyclability, cost and defect risk. The conclusion is appropriately evidence-based and does not overstate the preliminary design; it identifies FEA, fatigue, extreme loads, buckling, CFD/BEM refinement and prototype testing as appropriate subsequent work. The main limitations are some grammatical and equation-formatting issues and occasional inconsistencies in terminology and figure presentation.

Mark Summary

Assessment category	Maximum mark	Mark awarded
Engagement with Literature Skills	20	17
Knowledge and Understanding Skills	30	24
Cognitive and Intellectual Skills	20	17
Practical Application Skills	20	19
Transferable Skills for Life and Professional Practice	10	8
Total	100	85

Overall Feedback

This is one of the strongest submissions assessed. The work demonstrates a particularly complete engineering process, including independently derived BEM blade geometry, justified variation of NACA 44-series profiles, Granta screening, a properly weighted material-selection matrix, quantitative comparison of manufacturing routes, design-linked costing, sectional lift and drag, geometry-derived bending properties, bending and torsional stress calculations, factors of safety and detailed CAD evidence. A particular strength is that the very high calculated structural margins are correctly interpreted as an opportunity for future weight and cost optimisation rather than simply being presented as proof of an ideal design. The principal limitations are the less complete treatment of metal and ceramic manufacturing routes and the use of a solid structural model alongside a hollow cost model. Completing a consistent hollow-section structural redesign would be the most valuable next development.