

ACMA6000 Coursework Feedback

Student	Antony Pugh
Student ID	2221728
Assessment	Manufacture of Wind Turbine Blade
Final mark	86 / 100

1. Engagement with Literature Skills — 17/20

The report demonstrates a strong and well-targeted literature base covering aerodynamics, BEM theory, material selection, fatigue, manufacturing, cost modelling, structural behaviour and environmental exposure. It draws on recognised textbooks, British Standards, peer-reviewed papers, NREL work, ORE Catapult material and technical datasheets. The literature is used actively to justify design decisions rather than simply supporting general background statements. Examples include the use of published NACA 4412 aerodynamic data, engineering requirements, fatigue literature, composite property data and blade-cost modelling. Recent sources are also present alongside established engineering references. The mark is limited only because a small proportion of material-property data comes from commercial datasheets and web-based technical sources, and some source integration could be more critically discussed.

2. Knowledge and Understanding Skills — 25/30

The submission demonstrates very strong technical understanding across aerodynamic design, material behaviour, manufacturing and structural performance. A 2 MW rotor is developed from the design conditions and NACA 4412 geometry is then developed using BEM theory rather than through a purely assumed taper. The ideal chord distribution is deliberately linearised for manufacturability. The material discussion shows good understanding of specific strength, specific stiffness, fatigue, density and anisotropy, while the manufacturing section clearly distinguishes appropriate and inappropriate processes for metals, ceramics and composites. The report also recognises the limitations of simplified analysis and correctly identifies fatigue, buckling and combined loading as areas requiring further development. The main limitation is that the final structural model still relies on simplified shell assumptions and preliminary material properties rather than a fully developed laminate model, but this is appropriate for the level taught.

3. Cognitive and Intellectual Skills — 17/20

There is strong evidence of critical engineering judgement. The weighted decision matrix uses seven criteria with explicit weights and 1-5 scores, and the criteria are justified according to blade function. GFRP ranks highest, and the student then checks the robustness of this result by considering whether the conclusion changes under alternative weighting. This is a strong example of using the weighted decision matrix critically rather than mechanically. The comparative analysis also integrates strength, safety factor, cost, manufacturability, recyclability and environmental impact before reaching the final recommendation. A higher mark would require a completed design iteration or sensitivity study, for example changing shell thickness, chord, laminate assumptions or material allocation and then showing quantitatively how the revised design performs.

4. Practical Application Skills — 19/20

This is one of the strongest practical submissions in the cohort. The student completes the full engineering chain from BEM geometry to aerodynamic loads, structural calculations, costing and CAD. The appendix develops blade geometry at multiple spanwise positions, including local tip-speed ratio, inflow angle, twist, ideal chord, linearised design chord and relative velocity. Lift and drag are calculated and resolved into normal and tangential components; these are then used to calculate root bending moment and bending stress. Material-specific safety factors are calculated, including recognition of GFRP anisotropy and a separate compressive check. Torsional shear stress is also calculated using an appropriate thin-walled relationship. Cost analysis is geometry-based rather than generic, and the CAD requirement is fully satisfied.

through Excel-generated NACA profiles, a SolidWorks blade model and a complete general-arrangement drawing. No internal blade details were required.

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

The report is very well structured and easy to follow. The contents, table of figures and table of tables make the technical evidence straightforward to locate, and the report progresses logically from research and specification through material selection, manufacturing, cost, mechanical analysis, comparative evaluation and CAD. The figures and tables are purposeful, especially the BEM geometry tables, force-distribution graph, safety-factor tables and general-arrangement drawing. Conclusions are closely linked to the calculated results, and the recommendations identify realistic next steps including combined loading, fatigue, buckling, FEA, laminate design and end-of-life improvement. Minor equation-rendering and formatting inconsistencies prevent the professional presentation from reaching the very highest level.

Mark Summary

Assessment category	Maximum mark	Mark awarded
Engagement with Literature Skills	20	17
Knowledge and Understanding Skills	30	25
Cognitive and Intellectual Skills	20	17
Practical Application Skills	20	19
Transferable Skills for Life and Professional Practice	10	8
Total	100	86

Overall Feedback

This is an exceptionally complete and technically strong submission. Its main strengths are the BEM-derived blade geometry, justified linearisation for manufacture, robust weighted material-selection process, full comparison of manufacturing routes, geometry-linked cost analysis, complete lift/drag and bending calculations, material-specific safety factors, completed torsional analysis and strong CAD evidence. The selection of GFRP is consistently supported by aerodynamic, structural, manufacturing and cost evidence rather than by a single ranking result. The principal limitation is that the structural model remains deliberately simplified, particularly through the assumed shell thickness and preliminary laminate representation. The most valuable next step would be to refine the laminate and section properties and repeat the structural analysis using the final composite architecture.