

ACMA6000 Coursework Feedback

Student	Joe Shankland
Student ID	2317772
Assessment	Manufacture of Wind Turbine Blade
Final mark	72 / 100

1. Engagement with Literature Skills — 14/20

The report uses relevant independent literature to support aerodynamic design, blade geometry, material selection and manufacturing decisions. Appropriate academic sources include published work on wind-turbine development, blade materials, aerodynamic theory and chord/twist linearisation, alongside NREL and Ansys Granta information. The literature is applied rather than merely cited as background; in particular, a published linearisation approach is used to simplify the theoretical chord distribution for manufacture and CAD modelling. This demonstrates useful independent application of literature. However, the overall reference range is noticeably smaller than in the strongest submissions, and some significant numerical inputs would benefit from stronger direct sourcing. A wider body of recent research across manufacturing, cost and structural behaviour would strengthen this criterion.

2. Knowledge and Understanding Skills — 21/30

The submission demonstrates good understanding of wind-turbine aerodynamics and preliminary blade design. The report explains power coefficient, Betz limit, tip-speed ratio, lift and drag, BEM theory, chord variation and blade twist before applying those ideas to a specific 30,000 kWh/year dairy-farm application. The design is developed from an independently selected wind speed into swept area, rotor radius, diameter, rotational speed and five spanwise sections. The material discussion also demonstrates understanding of steel, aluminium, ceramics and GFRP and their structure-property limitations. Manufacturing coverage is complete across metals, ceramics and composites, including casting, extrusion, sintering, additive manufacture and vacuum infusion. The principal limitation is significant: the report does not develop the required mechanical analysis into blade-specific bending stress, torsional stress or safety-factor calculations.

3. Cognitive and Intellectual Skills — 14/20

There is good engineering reasoning in several parts of the work. The student does not simply accept the theoretical chord distribution but recognises that it would be difficult to manufacture and applies a literature-supported linearisation to create a more practical design. The weighted decision matrix is also logically constructed, with fatigue resistance and strength receiving the highest weighting, followed by density, manufacturing, cost and recyclability. The report also recognises the environmental disadvantage of GFRP rather than presenting the selected material uncritically. The main limitation is that the decision-making process is not supported by a complete structural evaluation. Consequently, the selected geometry and material are not quantitatively tested against bending and torsional stresses.

4. Practical Application Skills — 15/20

The submission contains substantial practical design evidence. Annual energy demand is converted into a required rotor size, producing a swept area, radius and diameter, and five spanwise chord sections are then calculated before NACA 4412 coordinates are generated. The appendices contain actual calculated upper and lower airfoil coordinates and graphs rather than only a final illustration. The CAD requirement is also well satisfied: the external blade views and annotated engineering drawing demonstrate the required blade skin and section geometry, with no requirement for internal structures. The principal weakness is the absence of blade-specific lift/drag force results developed through to bending stress, torsional stress and safety-factor calculations, which prevents the practical analysis from reaching the level of the strongest submissions.

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

The report is clearly and professionally structured, moving logically through literature, material selection, cost and environmental considerations, design calculations, manufacturing, CAD and conclusions. Tables, equations, CAD drawings and appendix graphs are integrated effectively, and the final design parameters are brought together clearly. The conclusion appropriately identifies the work as preliminary and avoids overstating the level of validation, recommending further structural, fatigue and experimental work before manufacture. Presentation is generally clean, although equation rendering and some document formatting could be improved further.

Mark Summary

Assessment category	Maximum mark	Mark awarded
Engagement with Literature Skills	20	14
Knowledge and Understanding Skills	30	21
Cognitive and Intellectual Skills	20	14
Practical Application Skills	20	15
Transferable Skills for Life and Professional Practice	10	8
Total	100	72

Overall Feedback

This is a well-structured and technically coherent preliminary blade-design submission with particular strengths in aerodynamic design methodology, literature-supported chord linearisation, material selection, complete manufacturing-route comparison and CAD presentation. The student demonstrates good ability to take an independently defined application and convert its energy requirement into a realistic blade geometry. The major limitation is the absence of the mechanical verification stage: the design is not carried through into blade-specific lift/drag loading, bending stress, torsional stress and safety-factor calculations. The most important improvement would therefore be to take the existing CAD and aerodynamic geometry and complete the structural calculations required by the assignment, allowing the selected material and blade dimensions to be quantitatively validated.