

ACMA6000 Coursework Feedback

Student	Aled James
Student ID	2320122
Assessment	Manufacture of Wind Turbine Blade
Final mark	75 / 100

1. Engagement with Literature Skills — 14/20

The report demonstrates relevant independent reading across wind-turbine aerodynamics, materials, manufacturing, fatigue, environmental exposure and composite processing. Appropriate engineering textbooks and specialist sources are used to support the discussion of NACA geometry, material properties, manufacturing processes and mechanical behaviour. The literature is generally connected to engineering decisions rather than appearing only in the bibliography. The discussion of fatigue and environmental loading identifies turbulence, wind shear, yaw, gravity, leading-edge erosion and moisture as important blade-design considerations. However, the source base is less academically robust than the strongest submissions. A significant proportion consists of general textbooks, independently published books and older sources, with comparatively little recent peer-reviewed journal literature.

2. Knowledge and Understanding Skills — 22/30

The submission demonstrates good technical understanding across aerodynamic design, NACA 4412 geometry, materials, manufacturing and structural behaviour. The rotor radius, tip-speed ratio and wind speed are used to calculate aerodynamic output and blade-tip velocity. The report also understands that NACA 4412 geometry must scale along the chord and recognises that a real blade would probably require different thickness profiles near the root and tip. Manufacturing knowledge covers metals, ceramics and composites, with appropriate process limitations and defects discussed. The main limitation is that some selected geometry, particularly the linear chord and twist distributions, is more assumed than fully aerodynamically derived. The torsional analysis is also introduced theoretically but not carried through to a numerical design result.

3. Cognitive and Intellectual Skills — 14/20

There is good evidence of engineering judgement, particularly in the decision to recommend a hybrid GFRP/CFRP solution rather than choosing a single material solely because it has the highest stiffness or strength. The report argues that GFRP provides a cost-effective shell material while CFRP could be used selectively where higher longitudinal stiffness is needed, thereby balancing performance and cost. The comparative analysis also evaluates density, stiffness, fatigue resistance, impact tolerance, manufacturability, defects and recyclability rather than focusing on a single property. However, the decision process is less quantitatively developed than submissions using a fully weighted 1-5 decision matrix with explicit criterion weights and calculated totals. The cost assumptions are also broad, limiting how strongly they can support the final hybrid recommendation.

4. Practical Application Skills — 17/20

The report contains substantial practical engineering work. Five spanwise NACA 4412 sections are defined from inner radius to tip, with chord, thickness, camber and twist values developed into the blade geometry. Section-by-section aerodynamic calculations are completed, with relative velocity, lift and drag evaluated across all five stations. These loads are then used to estimate root bending moment, bending stress and a preliminary safety factor. Torsional loading equations are correctly introduced, but no numerical torsional-stress result is completed. The CAD requirement is fully satisfied through both the 3D external blade model and a dimensioned engineering drawing showing the blade skin and spanwise profiles; no internal structure was required. The principal practical weakness is the cost model, which assumes a generic material volume rather than deriving the quantity directly from the actual CAD blade geometry.

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

The report is logically organised and follows a clear engineering-report structure from literature and specification through materials, manufacturing, costing, structural analysis, comparison, CAD and recommendations. The figures and tables are generally useful, particularly the spanwise aerodynamic loading table and the detailed CAD drawing. The conclusion identifies the preliminary nature of the analysis and appropriately recommends more advanced BEM analysis, optimised twist and chord, laminate theory, fatigue and buckling assessment for future development. The document remains understandable throughout, although recurring grammatical errors, equation-formatting issues and some imprecise technical phrasing reduce the overall professional finish.

Mark Summary

Assessment category	Maximum mark	Mark awarded
Engagement with Literature Skills	20	14
Knowledge and Understanding Skills	30	22
Cognitive and Intellectual Skills	20	14
Practical Application Skills	20	17
Transferable Skills for Life and Professional Practice	10	8
Total	100	75

Overall Feedback

This is a technically substantial submission with particularly good evidence of completed aerodynamic loading calculations, bending analysis, safety-factor evaluation and CAD blade development. The proposed GFRP/CFRP hybrid is reasonably justified through the balance between cost, mass and stiffness, and the manufacturing discussion covers all three required material families. The principal weaknesses are the comparatively weak quantitative material-selection process, the use of an assumed material volume in the cost analysis rather than the actual blade geometry, and the absence of a completed numerical torsional-stress calculation. The strongest improvement would be to derive the material quantity directly from the CAD model, complete the torsional analysis and use a formal weighted decision matrix to strengthen the final material recommendation.