

Feedback Report – ACMA6000

Student: Sheunesu Ziki

Student ID: 2205423

Assignment: Manufacture of Wind Turbine Blade

1. Engagement with Literature Skills – 16/20

The report demonstrates a good level of engagement with relevant literature, which aligns with the expectations of drawing upon credible sources to support engineering analysis. The student integrates recognised references such as aerodynamic texts and wind energy literature to support key concepts, for example when stating that “modern turbines operate at TSR values that are between 6 and 8” and that “practical designs can achieve C_p values of 0.4–0.48,” showing that the work is informed by established theory rather than unsupported assumptions.

There is also appropriate use of literature to justify material behaviour and environmental considerations, particularly when discussing fatigue cycles and offshore conditions. The inclusion of structured tables such as the comparison of mechanical properties demonstrates an attempt to synthesise literature into usable engineering data rather than simply listing sources.

However, the engagement remains largely descriptive. The literature is used to support statements, but there is limited evidence of critical comparison between sources or evaluation of their reliability. The work does not consistently demonstrate the “in-depth research informed by the latest developments” expected at the highest level. The absence of deeper critique, such as comparing alternative aerofoils or contrasting different reported C_p values, limits the mark. Further improvement would require more critical discussion of sources and stronger integration of high-level academic material into the decision-making process.

2. Knowledge and Understanding Skills – 24/30

The submission demonstrates a very good level of knowledge and understanding, with clear evidence of coherent and detailed subject knowledge across aerodynamic, material and manufacturing domains. The student shows understanding of key aerodynamic principles through explanations of the NACA 4412 profile, lift-to-drag ratio and the relationship between TSR, wind speed and blade geometry. For example, the explanation that the aerofoil “allows for a good lift to drag ratio” and the discussion of loading cycles over the turbine lifespan indicate awareness of real engineering constraints.

There is also strong understanding of material selection principles, particularly in recognising that composites offer superior specific strength and fatigue resistance compared to metals and ceramics. The report effectively links material properties to application requirements, demonstrating an ability to interpret engineering data rather than simply present it. Similarly, the discussion of environmental conditions shows awareness of practical operational challenges such as corrosion, UV exposure and moisture ingress.

While concepts are clearly explained, there is limited exploration of their limitations or competing approaches. For example, design parameters such as TSR and C_p are presented with supporting values, but the reasoning behind their selection is not fully developed or critically justified. To achieve a higher

mark, the student would need to demonstrate deeper insight by questioning assumptions, comparing alternative design approaches, and explicitly linking theory to design decisions.

3. Cognitive and Intellectual Skills – 16/20

The report shows sound cognitive and intellectual skills, particularly in the way it structures comparisons and reaches justified conclusions. The use of a weighted decision matrix to evaluate materials demonstrates the ability to apply structured analytical methods, and the selection of GFRP is logically supported by the calculated scores and engineering reasoning.

There is also clear evidence of evaluation in the comparison of manufacturing methods, where processes such as casting, extrusion, RTM and vacuum infusion are assessed based on scalability, cost and defect risks. The conclusion that vacuum infusion is the most suitable method is supported by comparative data and discussion, rather than being asserted without justification. Similarly, the cost-performance analysis shows an ability to balance multiple engineering factors, including lifecycle cost, weight and structural performance.

However, the depth of critical analysis remains limited. The decision-making process is logical but largely confirmatory, with little exploration of alternative scenarios or sensitivity to assumptions. For instance, while weighting factors are applied in the decision matrix, there is no discussion of how changing these weightings might influence the outcome. The work therefore aligns with a “sound evaluation” rather than the “sophisticated judgement” expected at the highest level. Greater depth could be achieved through more critical interrogation of assumptions, exploration of competing solutions, and stronger justification of analytical choices.

4. Practical Application Skills – 18/20

This is a particularly strong aspect of the submission, demonstrating very good application of engineering methods and techniques. The report includes detailed aerodynamic calculations, cost estimations, material selection processes and structural analysis, all of which align well with the assignment requirements.

The aerodynamic analysis is clearly structured, with calculations of angular velocity, relative wind speed, lift and drag forces, followed by tabulated results across blade sections. The presentation of these results in Table 9, along with interpretation such as the observation that lift peaks at $r/R = 0.7$, shows effective application of theory to practical design.

The structural analysis further strengthens this section, where the student calculates root bending moments, torsional moments and resulting stresses. The comparison of calculated stress (approximately 82.9 MPa) with material strength values demonstrates a clear link between analysis and design validation.

Additionally, the inclusion of cost modelling with detailed breakdowns of material quantities and manufacturing costs shows strong practical engagement with real-world engineering considerations. The presence of multiple tables, figures and a CAD model further supports the application of tools and techniques expected at this level.

However, some calculations rely on simplified assumptions, such as modelling the root section as a simple rectangular section, and not all working steps are fully expanded. There is also limited use of graphical outputs to support the calculations. To improve further, the student could include more detailed calculation steps, additional engineering graphs such as stress distribution or lift variation along the blade, and more advanced modelling approaches.

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

The report is well organised and presented in a professional format, demonstrating strong transferable skills. The structure follows a logical progression from introduction through to conclusion, with clear sectioning and appropriate use of headings. The inclusion of figures and tables throughout the report enhances clarity and supports communication of technical information.

The writing is generally clear and appropriate for a technical audience, and the use of labelled diagrams, tables and CAD visuals contributes to effective communication. The report is easy to follow, and the logical flow between sections reflects good planning and organisation.

Some sentences could be more concise, and there are occasional grammatical inconsistencies. In addition, the presentation of equations could be improved to enhance readability and professionalism. Addressing these points would bring the work in line with the highest standard of professional communication.