

ACMA5002 Coursework Feedback

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Selected topic/product/project: Injection-Moulded Laptop Cooling Fan Blade

Final mark: 80/100

1. Engagement with Literature Skills — 10/15

The report uses relevant technical and industrial sources covering QFD, FEA, CFD, injection-moulding simulation, fan-market performance, DFM and material behaviour. The market review is particularly useful because it compares existing laptop coolers by fan arrangement, price, noise and airflow and then uses this evidence to establish the design direction. Literature is also applied to draft angles, simulation methods and material comparison rather than appearing only as background information. However, the overall research base is relatively limited, with substantial reliance on websites and few peer-reviewed journal papers, engineering standards or authoritative texts on fan aerodynamics, polymer fatigue and injection moulding. A higher mark would require a broader academic evidence base and stronger referencing of material properties, loading assumptions and process parameters.

2. Knowledge and Understanding Skills — 24/30

The submission demonstrates very good understanding of fan design, DFM, DFA, injection moulding, rotational loading, aerodynamic performance and polymer selection. The design incorporates a castellated motor-locating feature, axle recess, drafted hub geometry, filleted blade-to-hub transitions and reasonably uniform thickness around the central section. The report also demonstrates understanding of how imbalance affects bearing wear, noise and service life and how blade geometry influences airflow and structural response. ABS, Nylon 6 and polypropylene are compared using density, stiffness, cost, recyclability and mouldability before ABS is selected. The technical knowledge would be strengthened by a clearer dimensional-tolerance specification, more detailed manufacturing process planning and a fuller discussion of fatigue, overspeed and production balancing requirements.

3. Cognitive and Intellectual Skills — 25/30

The analytical process is strong and reflects genuine iterative optimisation. Market research and QFD establish airflow, noise, blade balance and service life as key drivers, while the FMEA identifies warpage, weld-line weakness, hub voids and imbalance as priority risks. The initial design is assessed through FEA and CFD, after which the blade profile, hub and blade-root transitions are modified and reanalysed. The swept-cut revision reduces predicted Von Mises stress by more than 50% and blade-tip displacement by more than 75%, while the report also recognises the resulting reduction in blade area and airflow. Plastics analysis identifies air traps, cooling time and sink marks, and the geometry is subsequently revised to remove several of these concerns. Higher achievement would require a formal DOE table with controlled factors and measured responses, clearer final numerical acceptance criteria and stronger validation of the claimed 100 CFM airflow.

4. Practical Application Skills — 13/15

The submission demonstrates very good practical use of SolidWorks CAD, Simulation, Flow Simulation and Plastics. Multiple design iterations are shown, including initial, balanced and final manufacturable configurations. FEA is used to assess centrifugal loading, stress concentration and blade-tip displacement, while CFD provides airflow and velocity evidence and helps evaluate the effect of blade-profile modifications. Injection-moulding analysis reports fill pressure, fill time, thermal variation, cooling time, air traps, weld lines and sink marks, with results used to introduce draft, fillets and changes to the hub and blade roots. This is substantial practical evidence. The principal limitations are that the final ABS design is not fully revalidated

through all FEA and CFD studies, numerical mesh and boundary-condition details are limited, and no completed fatigue or overspeed simulation is included.

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

The report is logically structured and contains an abstract, contents page, clear sections, market-comparison tables, QFD, FMEA, CAD figures, simulation outputs, calculations, recommendations, conclusion and references. The discussion communicates the design-development process clearly and distinguishes between aerodynamic, structural, manufacturing and economic trade-offs. Particularly good professional judgement is shown in recognising that reducing blade deflection also reduced aerodynamic area and that physical prototype testing remains necessary despite the simulation work. The cost and break-even calculations are clear and easy to follow. Presentation could be improved through more consistent figure numbering, proofreading, clearer equation formatting and a concise summary table comparing the initial and final designs against every customer requirement.

Mark summary

Assessment category	Maximum mark	Mark awarded
Engagement with Literature Skills	15	10
Knowledge and Understanding Skills	30	24
Cognitive and Intellectual Skills	30	25
Practical Application Skills	15	13
Transferable Skills for Life and Professional Practice	10	8
Total	100	80