Course report 2025

Advanced Higher Engineering Science

This report provides information on candidates' performance. Teachers, lecturers and assessors may find it useful when preparing candidates for future assessment. The report is intended to be constructive and informative, and to promote better understanding. You should read the report with the published assessment documents and marking instructions. For information about the project, which is internally assessed, please refer to the 2024–25 Qualification Verification Summary Report on the subject page of our website.

We compiled the statistics in this report before we completed the 2025 appeals process.

Grade boundary and statistical information

Statistical information: update on courses

Number of resulted entries in 2024: 56

Number of resulted entries in 2025: 58

Statistical information: performance of candidates

Distribution of course awards including minimum mark to achieve each grade

Course award	Number of candidates	Percentage	Cumulative percentage	Minimum mark required
A	9	15.5	15.5	103
B	15	25.9	41.4	89
C	8	13.8	55.2	75
D	11	19.0	74.1	61
No award	15	25.9	100%	Not applicable

We have not applied rounding to these statistics.

You can read the general commentary on grade boundaries in the appendix.

In this report:

- ‘most’ means greater than or equal to 70%
- ‘many’ means 50% to 69%
- ‘some’ means 25% to 49%
- ‘a few’ means less than 25%

You can find statistical reports on the statistics and information page of our website.

Section 1: comments on the assessment

Question paper

Overall, the question paper performed as intended. Responses to section 1 of the question paper reflected the intended level of demand of the questions, apart from question 8. Section 2 of the question paper was more demanding; particularly question 10, as many candidates did not answer the final part of the question. We considered this when setting grade boundaries.

Section 2: comments on candidate performance

Areas that candidates performed well in

Question paper

Most candidates answered questions relating to the following course content: activity network diagrams in project management, shear force and 3D forces on driveshafts in structures, beam deflection and second moment of area of hollow sections in materials, and symbolic representation of grid components in generation and transmission. Many candidates demonstrated an understanding of nodal analysis in analogue electronics.

Question 1(a)(i)	Most candidates understood how to use precedence arrows in an activity network diagram.
Question 1(a)(ii)	Most candidates established a latest finish time for a node acting as a precedent for more than one node (for example, node E) correctly and established the latest start times correctly. Most candidates correctly established an earliest start time for a

node having more than one precedent (for example, node D) and float values for each of the required nodes.

Question 1(a)(iii) Most candidates identified the correct critical path from their completed activity network diagram.

Question 2 Most candidates understood what form the shear force diagram should take and plotted key values accurately, but a few arithmetic errors were evident in the calculation of the beam reactions.

Question 3 Most candidates calculated the useful power, the electrical power and then the overall efficiency as the ratio of the electrical power to the input power. A few candidates recognised that 3/8 (0.375) is an efficiency in terms of electrical power generation within useful power generation, and used a compound efficiency calculation (0.82×0.375) to complete the efficiency calculation.

Question 4(a) Most candidates could identify at least two transmission grid symbols correctly and some candidates identified all four symbols correctly.

Question 5(a) Most candidates recognised that the output from the first stage of the circuit would be a negative voltage and that a positive output range of voltages was specified for the circuit.

Question 6(a) Most candidates calculated a frequency with correct magnitudes of resistance and capacitance, and many candidates applied component tolerances correctly to determine the highest possible frequency.

Question 7(a) Many candidates answered correctly, but some did not establish the weight from the given mass that the board supports and a few did not divide by the length of the board.

Question 7(b) A few candidates gained full marks for this question, but most gained partial credit for their work. Candidates who gained partial credit either did not establish parameter values ω, L, E and I with consistent units before completing the calculation, or did not halve the length of the board. Most candidates selected the correct deflection formula. A few candidates confused breadth and depth dimensions when they calculated the second moment of area of the cross-section.

Question 9(a)	Most candidates gained either 4 marks or full marks for this question. Some candidates also attempted to establish the direction of the force at the bearing, and a few established the second bearing force. These were not asked for and gained no credit.
Question 9(c)	Many candidates answered this question successfully and some gained full marks. Candidates who did not gain full marks tended not to recognise that the smaller contact angle on the drive pulley made it more likely to slip at that location — the exponential term in the mathematical model for slip having a smaller value than for the larger contact angle on the driven pulley.
Question 9(f)	Many candidates demonstrated an ability to apply nodal analysis correctly at the non-inverting terminal of the op-amp using Kirchhoff's current law and Ohm's Law. However, having established two equations, only some candidates solved them fully. A few candidates confused the relationship between the two output states of the Schmitt trigger and the resulting two threshold voltages at the non-inverting terminal.
Question 10(a)	Many candidates determined the second moment of area of the rectangular hollow section correctly from the given external and internal dimensions.

Areas that candidates found demanding

Question paper

Many candidates incorrectly answered or omitted questions related to either digital electronics and programmable control, or drive systems. Some candidates did not answer questions that required descriptive or explanatory statements in sufficiently detailed language.

Question 1(b)	Many candidates’ responses were lists of activities without any explanation of why the activity is necessary.
Question 4(b)(i)	Many candidates described the function of a busbar, however, almost as many either could not describe the function or gave responses that were too vague to gain the mark.
Question 4(b)(ii)	Many candidates described the function of a circuit breaker, however, almost as many either could not describe the function or gave responses that were too vague to gain the mark.
Question 5(b)	Many candidates answered correctly, but an almost equal number gave either ‘15’ rather than ‘16’, or a number unrelated to the number of input line combinations.
Question 5(c)	Many candidates gained at least 2 marks, but only some gained full marks. Candidates who lost the third mark tended to be unclear about the need for the least significant bit of the digital input to be connected to the largest resistor.
Question 6(b)	A few candidates demonstrated that they knew the resistor ratio must be 2 because the resistors are connected around the op-amp in a non-inverting arrangement, and the amplifier gain must be 3 for the circuit to oscillate at a steady amplitude theoretically.

Question 6(c)	The knowledge deficit apparent for many candidates in question 6(b) suggested that some candidates guessed this answer correctly. The attenuating amplitude suggests that the gain is too low, so the resistor has too large a value.
Question 8	A few candidates understood this question and answered fully. Most candidates did not answer. All candidates should be aware of AND, OR and XOR truth tables from lower levels of this qualification, and ‘bitwise’ logic was exemplified in the question.
Question 9(b)	Many candidates calculated a torque in the system correctly, but only some calculated the power transmitted to the drive based on the speed of a pulley and the torque acting on the same pulley.
Question 9(d)	A few candidates calculated the duty cycle for the pulses correctly. A few candidates miscalculated the bracketed term in the first formula and a few candidates miscalculated the frequency of the pulses for the second formula.
Question 9(e)(i)	Some candidates identified either a rectifier or a step-down transformer as required sub-systems, but very few could identify both.
Question 9(e)(ii)	Some candidates gained partial credit for a description of the function of the component that they identified in the previous part of the question.
Question 10(b)	Many candidates gained no marks for this question, and only very few gained most of the marks available. The question was intentionally demanding.
Question 10(c)	Most candidates gained no marks for this question. Most candidates did not correctly incorporate the moment indicated on the free-body diagram into a moment equilibrium equation. The question was intentionally demanding.

Question 10(d) Some candidates plotted a load line correctly. A few candidates established both the drain-current and gate-source voltage correctly for the quiescent point. The specified drain-source voltage at the quiescent point in this question meant that candidates could find the two values without the load line if they calculated the drain current using the voltage drop across the load resistor, and then found the gate-source voltage from the graph of the MOSFET characteristics.

Question 10(e) Some candidates successfully found a resistor ratio based on a required gate voltage that, if incorrect, was accepted as a follow-through error from question 10(d). Some candidates began to correctly apply the resistor ratio to the specified input resistance condition, but only a few then worked through to correct values for the two resistors.

Question 10(f) A few candidates attempted this question and very few showed they understood the range of values, 0 to 1023, that a 10-bit analogue to digital converter would produce. This question, along with question 5(b), suggested that the number of combinations of digital input states for a DAC and digital output states for an ADC was not secure knowledge for candidates.

Question 10(g) No candidate answered this question successfully. Understanding of analogue to digital conversion, duty cycle and frequency was necessary. The question was intentionally demanding.

Section 3: preparing candidates for future assessment

Question paper

Candidates should not round their working in calculations until they reach a final value. They should then round to the fewest number of significant figures present in quoted data values in the question, as outlined in the general instructions on the question paper.

The numerical value should be accompanied by the correct units for the quantity calculated and preferably expressed in engineering notation, as tabulated on page 5 of the data booklet. Engineering notation will conflict with candidates' experience of standard (or scientific) notation used in Mathematics and Physics. However, on most scientific calculators, the 'ENG' button gives any final answer with a power of 10 that can be replaced by the appropriate decimal prefix.

When substituting values in formulae, candidates must be able to adjust the orders of magnitude of variables so that their units are consistent with one another. Question 7(b) from this year's question paper is a good example to consider.

Candidates should understand the relationship between torque and rotational speed of the pulleys in a belt drive. Their product is a constant for each pulley if the drive is assumed to run without slip, so calculation of transmitted power must involve the torque and running speed of the drive pulley, or the torque and running speed of the driven pulley.

'Duty cycle', 'frequency', 'period' and 'mark space ratio' are common terms used to define digital pulses, and candidates should understand them from work they have done in the digital and programmable electronics part of the course. Of these, 'duty cycle' is least likely to be used at National 5 and Higher and so was defined in both question 9(d) and question 10(g), despite its use having precedents in past papers. It is used commonly in power electronics and in Arduino programming. The definition did not appear to help some candidates.

In the same area of course content, candidates should be clear about the numbers of digital states that combinations of digital input lines to a DAC and digital output lines from an ADC can generate, along with the decimal equivalents of the maximum values that the lines can represent.

Number of digital input lines	Number of digital states	Maximum value (decimal equivalent)
n	2^n	$2^n - 1$

These would also apply to registers within microcontroller architecture.

To achieve all available marks, candidates must devote significant time to their own reading to move their subject knowledge beyond Higher level content and depth of understanding, particularly in relation to the course themes at Advanced Higher level. This increases candidates' capacity to respond to questions in the question paper that require either description, explanation or discussion.

Appendix: general commentary on grade boundaries

Our main aim when setting grade boundaries is to be fair to candidates across all subjects and levels and to maintain comparable standards across the years, even as arrangements evolve and change.

For most National Courses, we aim to set examinations and other external assessments and create marking instructions that allow:

- a competent candidate to score a minimum of 50% of the available marks (the notional grade C boundary)
- a well-prepared, very competent candidate to score at least 70% of the available marks (the notional grade A boundary)

It is very challenging to get the standard on target every year, in every subject, at every level. Therefore, we hold a grade boundary meeting for each course to bring together all the information available (statistical and qualitative) and to make final decisions on grade boundaries based on this information. Members of our Executive Management Team normally chair these meetings.

Principal assessors utilise their subject expertise to evaluate the performance of the assessment and propose suitable grade boundaries based on the full range of evidence. We can adjust the grade boundaries as a result of the discussion at these meetings. This allows the pass rate to be unaffected in circumstances where there is evidence that the question paper or other assessment has been more, or less, difficult than usual.

- The grade boundaries can be adjusted downwards if there is evidence that the question paper or other assessment has been more difficult than usual.
- The grade boundaries can be adjusted upwards if there is evidence that the question paper or other assessment has been less difficult than usual.
- Where levels of difficulty are comparable to previous years, similar grade boundaries are maintained.

Every year, we evaluate the performance of our assessments in a fair way, while ensuring standards are maintained so that our qualifications remain credible. To do this, we measure evidence of candidates' knowledge and skills against the national standard.

For full details of the approach, please refer to the Awarding and Grading for National Courses Policy.