SCOTTISH QUALIFICATIONS AUTHORITY

Scottish Group Award Specifications

SGA in:	**Engineering: Mechatronics**		
Level:	**Higher**	**Code:**	**G5AJ 12**

Summary of requirements

SGA in Engineering: Mechatronics at Higher

National Courses and Units required*

1 mandatory National Course (4 credits) at Higher:
Mechatronics

Details in specific section

plus

2 National Courses (8 credits) at Higher from:
Electronics
Manufacturing
Mathematics
Mechanical Engineering
Technological Studies

Details in specific section

plus

1 mandatory National Unit (0.5 credit):
Engineering Quality Assurance (H)

Details in specific section

plus

1 National Unit (1 credit):
Core Mathematics 4 (Int 2)

or

2 National Units (2 x 0.5 credit):
Mathematics: Craft Technology 1 (Int 2)
Mathematics: Craft Technology 2 (Int 2)

Details in specific section

plus

1 National Unit (1 credit) from:
Technical Graphics 2 (Int 2)
Computer Graphics (Int 2)
Graphic Communication: An Introduction (Int 2)
Engineering Draughting (H)
Graphic Engineering Communication (H)

Details in specific section

plus

5.5 credits at minimum of Intermediate 2

Details in specific section

Total 20 credits

Core skills required*

The above must include or cover:
1 core skill at Higher
4 core skills at Intermediate 2

Details in specific section

*See Important Note on page 4.

Rules for credit contribution

Important Note* Achievement above the minimum requirements

The specification shows the **minimum** requirements for this SGA. Where possible, centres may wish to encourage candidates to exceed this minimum. Candidates achieving above the minimum specification will have this achievement recorded on their Scottish Qualifications Certificate.
For example the following can be achieved above the minimum requirement:

- Core Skills at levels above those specified
- more National Courses and Units at Higher instead of the credits at Intermediate 2
- National Course grades, eg grade A or B instead of grade C
- more than the required three National Courses, in which case each additional course completed counts as four credits

Hierarchies

- courses and units can be substituted by those with the same title at a higher level, eg Mathematics 1 (Int 2) can be substituted by Mathematics 1 (H) (See Section C)

Double counting

- courses and units with the same title at different levels cannot both contribute credits to the SGA, eg **either** Mathematics 1 (Int 2) **or** Mathematics 1 (H)
- courses at the same level in the same subject cannot both contribute credits to the SGA, eg **either** the National Course in Technological Studies at Higher or SCE Higher Grade Technological Studies (See Sections D and E)
- same course achieved with different grades cannot both contribute credits to the SGA, eg **either** Higher Mechatronics at grade A **or** Higher Mechatronics at grade C

National Course awards at Grade D

National Course awards at Grade D can contribute to the SGA in the following ways:

- in place of the specified mandatory or optional Higher Courses, a grade D at Advanced Higher (or above) in a Course of the same title can contribute 4 credits to the SGA
- in place of the specified optional Intermediate 2 Courses, a grade D at Higher (or above) in a Course of the same title can contribute 4 credits to the SGA.

Note - The former compensatory course awards (fallbacks) can also contribute to the SGA:

- in place of the specified mandatory or optional Higher Courses, a compensatory award for a Course of the same title taken at Advanced Higher (ie awarded at Higher) can contribute 4 credits to the SGA

  in place of the specified optional Intermediate 2 Courses, a compensatory award for a Course of the same title taken at Higher (ie awarded at Intermediate 2) can contribute 4 credits to the SGA.

Specific section

A

This section specifies: mandatory courses, mandatory units, mandatory combinations of courses and/or units, mandatory core skill requirements and optional courses and units.

*Mandatory unit of a course. †Optional unit of a course. All other units are free-standing National Units.
[ ]Bracketed numbers indicate the former coding for these unrevised National Units.

Course/unit no	Course/unit title	Credits
One mandatory National Course:		
C028 12	Mechatronics (H)	4
plus two National Courses from:		
C027 12	Electronics (H)	4
C032 12	Manufacturing (H)	4
C031 12	Mechanical Engineering (H)	4
C036 12	Technological Studies (H)	4
or one National Course from above and one from:		
C100 12	Mathematics: Maths 1, 2 and 3 (H)	4
C102 12	Mathematics: Maths 1, 2 and Specs (H)	4
plus one mandatory National Unit:		
D06H 12	Engineering Quality Assurance (H)	0.5
plus one or two National Units to gain one credit from:		
D11V 11	Core Mathematics 4 (Int 2) [7180331]	1
D0N0 11	Mathematics: Craft Technology 1 (Int 2) [91045]	0.5
D0N1 11	Mathematics: Craft Technology 2 (Int 2) [91046]	0.5
plus one National Unit from:		
D988 12	Engineering Draughting (H)	1
D993 12	Graphical Engineering Communication (H)	1
D997 11	Graphical Communication: An Introduction (Int 2)	1
D173 11	*Computer Graphics (Int 2)	1
D172 11	*Technical Graphics 2 (Int 2)	1
	Total credits required: 14.5	

plus any combination of courses, component units and free-standing units to gain 5.5 credits (at minimum Int 2) from the above (not already chosen) and/or from:

Design

Course:

C025 11	Electronic and Electrical Fundamentals (Int 2)	4

Component units of course:

D134 11	*Combinational Logic (Int 2)	1
D132 11	*Electrical Fundamentals (Int 2)	1
D133 11	*Semiconductor Applications: An Introduction (Int 2)	1

Course/unit no	Course/unit title	Credits
Free-standing National Units:		
E9RR 12	Circuit Elements (H) [2160020]	0.5
E9S4 12	Computer System Networks (H) [2150080]	1
EB2A 12	Introduction to Basic Semi-Conductor Manufacturing Procedures (H) [2150101]	1
E9SB 12	Logic Families and Digital Systems Analysis (H) [2150020]	1
EG1M 12	Mechatronics Applications (H) [2130046]	0.5
EF04 12	Microelectronics for Mechatronics (H) [2150166]	1
E9S0 12	Single Phase AC (H) [2160030]	1
EB0R 11	Basic Micro-Soldering (Int 2) [2310011]	1
E9LG 11	Computing in Engineering 1 (Int 2) [2260100]	1
E7W6 11	Engineering Manufacturing Processes 1 (Int 2) [64703]	1
ED6T 11	Industrial Measurement and Control (Int 2) [3151034]	1
E7RR 11	Materials: Stress and Strain (Int 2) [64065]	0.5
D00R 11	Surface Mount Technology Rework: Concepts (Int 2)	1
D00S 11	Surface Mount Technology Rework: Practice (Int 2)	1
Health and Safety		
Free-standing National Unit:		
D11R 12	Health and Safety in the Work Place (H) [7161324]	1
Manufacture		
Course:		
C025 11	Electronic and Electrical Fundamentals (Int 2)	4
Component units of course:		
D134 11	*Combinational Logic (Int 2)	1
D132 11	*Electrical Fundamentals (Int 2)	1
D133 11	*Semiconductor Applications: An Introduction (Int 2)	1
Component unit of Process Control course:		
ED69 12	*Process Control (H) [3150564]	1
Free-standing National Units:		
EE9Y 12	CNC Part Programming (H) [8220006]	1
D2XX 12	Complex Program Controlled Systems (H) [3151044]	1
D991 12	Engineering Systems: Hydraulics (H)	0.5
EE9L 12	Engineering Systems: Pneumatics (H) [2190006]	0.5
EE99 12	Manufacturing Systems 1 (H) [8220016]	1
D00C 12	Manufacturing Systems 2 (H)	1
EF03 12	Mechatronic Control Systems (H) [2130016]	1
D2XY 12	Program Controlled Systems (H) [3150624]	1
ED6H 12	Programmable Logic Controllers (H) [3150644]	1
E96H 11	Engineering Systems 1: Machines and Mechanisms (Int 2) [84410]	1
D998 11	Robotics: An Introduction (Int 2)	0.5

Course/unit no	Course/unit title	Credits
Maintenance		
Component units of Electronic and Electrical Fundamentals course:		
D134 11	*Combinational Logic (Int 2)	1
D132 11	*Electrical Fundamentals (Int 2)	1
D133 11	*Semiconductor Applications: An Introduction (Int 2)	1
Component unit of Engineering Craft Skills course:		
D181 11	†Practical Electronics (Int 2)	1
Free-standing National Units:		
EE9K 12	Fault Diagnosis on Basic Electronic Circuits (H) [2150096]	1
EE9J 12	Fault Diagnosis on Complex Electronic Circuits and Systems (H) [2150136]	1
D994 12	Industrial Plant Maintenance (H)	1
E9S7 12	Integrated Circuit Applications (H) [2150260]	1
E7S2 12	Power Electronics (H) [64165]	1
E9S6 11	Electronic Components and Circuit Assembly Techniques (Int 2) [2150220]	1
E9S9 11	Introduction to Electronic Test Equipment and Measurements (Int 2) [2150410]	0.5
ED8C 11	Soldering Techniques on Electronic Circuits (Int 2) [2150034]	1
ED8B 11	Wiring and Assembly Techniques (Int 2) [2150024]	0.5
D999 11	Workshop Skills: An Introduction (Int 2)	1
Mathematics		maximum of three credits from this option
Component units of Mathematics course:[1]		
D321 11	Mathematics 1 (Int 2)	1
D322 11	Mathematics 2 (Int 2)	1
D323 11	Mathematics 3 (Int 2)	1
D324 11	Applications of Mathematics (Int 2)	1
	[1]See Rules for credit contribution	
Free-standing National Units:		
ED51 12	Mathematics: Analysis/Algebra 2 (H) [7180414]	1
D11W 11	Mathematics: Analysis/Algebra 1 (Int 2) [7180401]	1
ED50 12	Mathematics: Calculus 1 (H) [7181144] **or**	1
EE3X 12	Mathematics: Calculus A (H) [7181155]	0.5
Technological Studies		
C036 11	Technological Studies (Int 2)[1]	4
Component units of course:		
D186 11	*Applied Electronics (Int 2)	1
D185 11	*Energy (Int 2)	0.5
D188 11	*Mechanical Systems (Int 2)	0.5
D187 11	*Systems and Control (Int 2)	1
	[1]See Rules for credit contribution	
Working with Others		
Free-standing National Unit:		
D36H 11	Work Experience (Int 2)	1

Course/unit no	Course/unit title	Credits

Core Skills

Free-standing National Units:

D01B 11	Communication (Int 2)	1
D01C 11	Numeracy (Int 2)	1
D01D 11	Information Technology (Int 2)	1
D01E 12	Problem Solving (H)	1
D01F 11	Working with Others (Int 2)	1

SVQs can contribute credits to this SGA. (See Section F)

Total credits required: 5.5

20 credits

** Core skills requirement

Communication at Intermediate 2
Numeracy at Intermediate 2
Information Technology at Intermediate 2
Problem Solving at Higher
Working with Others at Intermediate 2

** See Section B for core skills details.

Rules for credit contribution

Important Note* Achievement above the minimum requirements

The specification shows the **minimum** requirements for this SGA. Where possible, centres may wish to encourage candidates to exceed this minimum. Candidates achieving above the minimum specification will have this achievement recorded on their Scottish Qualifications Certificate.
For example the following can be achieved above the minimum requirement:

- Core Skills at levels above those specified
- more National Courses and Units at Higher instead of the credits at Intermediate 2
- National Course grades, eg grade A or B instead of grade C
- more than the required three National Courses, in which case each additional course completed counts as four credits

Hierarchies

- courses and units can be substituted by those with the same title at a higher level, eg Mathematics 1 (Int 2) can be substituted by Mathematics 1 (H) (See Section C)

Double counting

- courses and units with the same title at different levels cannot both contribute credits to the SGA, eg **either** Mathematics 1 (Int 2) **or** Mathematics 1 (H)
- courses at the same level in the same subject cannot both contribute credits to the SGA, eg **either** the National Course in Technological Studies at Higher or SCE Higher Grade Technological Studies (See Sections D and E)
- same course achieved with different grades cannot both contribute credits to the SGA, eg **either** Higher Mechatronics at grade A **or** Higher Mechatronics at grade C

National Course awards at Grade D

National Course awards at Grade D can contribute to the SGA in the following ways:

- in place of the specified mandatory or optional Higher Courses, a grade D at Advanced Higher (or above) in a Course of the same title can contribute 4 credits to the SGA
- in place of the specified optional Intermediate 2 Courses, a grade D at Higher (or above) in a Course of the same title can contribute 4 credits to the SGA.

Note - The former compensatory course awards (fallbacks) can also contribute to the SGA:

- in place of the specified mandatory or optional Higher Courses, a compensatory award for a Course of the same title taken at Advanced Higher (ie awarded at Higher) can contribute 4 credits to the SGA

in place of the specified optional Intermediate 2 Courses, a compensatory award for a Course of the same title taken at Higher (ie awarded at Intermediate 2) can contribute 4 credits to the SGA.

Core skills

B

To achieve this SGA, all candidates **must achieve** the following core skills:

Core skill	Level
Communication	Intermediate 2
Numeracy	Intermediate 2
Information Technology	Intermediate 2
Problem Solving	Higher
Working with Others	Intermediate 2

One or more core skills units in this SGA may be automatically certificated through mandatory courses and units. Where this is the case, the corresponding core skill unit in this section cannot be counted towards the SGA.

Candidates can achieve core skills:

- through Standard Grades or other units which give automatic certification of core skills, eg a candidate who has completed Standard Grade English at Credit Level is given automatic certification of Communication at Intermediate 2
- by selecting from the group award units and courses which give automatic certification of core skills, eg the Higher Technological Studies course gives automatic certification of Problem Solving and Numeracy at Higher and Information Technology at Intermediate 2
- by doing dedicated core skills units – these units can contribute credits to the SGA and should be achieved through integration with appropriate subject specialist units. However, if the candidate wishes, the unit credits need not contribute to the SGA.

Candidates' current level of achievement in core skills is shown on the Scottish Qualifications Certificate in the form of a profile. This shows achievement against each of the core skills *components.* Where a core skill has more than one component, the candidate needs to achieve each component at the level specified for the SGA. For example, if an SGA requires Problem Solving at Higher, a candidate whose profile shows Critical Thinking and Planning and Organising at Higher and Reviewing and Evaluating at Intermediate 2 would not meet the requirement and would have to improve in Reviewing and Evaluating.

Details of all courses which give automatic certification of core skills is published in the *Catalogue of Core Skills in National Qualifications* (SQA, 2001/2002).

Hierarchical sequences

C

The SQA numbering system for qualifications consists of a 4 + 2 reference code.

The qualifications in a hierarchical sequence have the same title and are available at more than one level. They are identified by their reference code having the same first four digits, eg D186 in the example below. The last two digits are unique to each level of qualification, eg 12 equates to Higher, 11 equates to Intermediate 2.

Units

The following is an example of a hierarchical sequence of units:

D186 11	Applied Electronics (Int 2)
D186 12	Applied Electronics (H)
D186 13	Applied Electronics (AH)

Where units which are part of hierarchical sequences are specified, candidates who achieve a unit at a higher level than the one specified can use the upper level unit to count as credit towards the group award. For example, Applied Electronics (H) can be counted instead of Applied Electronics (Int 2).

Candidates can only use one of these units to count as credit towards the group award.

In the case of unrevised National Certificate Modules, ie units which retain their original number, there are hierarchies where the title is the same and the number is different. Details of these exceptions will be published in a separate document. The pattern for these hierarchies is the same as that previously established for GSVQs.

There are also some hierarchies where the titles and numbers of the units at different levels are different. In this specification, if there are two units at different levels with heavily overlapping content, only one of these units should be used to count as credit towards the group award. Details of these exceptions will be published in a separate document.

Courses

The following is an example of a hierarchical sequence of courses:

C036 11	Technological Studies (Int 2)
C036 12	Technological Studies (H)
C036 13	Technological Studies (AH)

In the SGA specification, where courses which belong to hierarchical sequences are specified, candidates who achieve a course at a higher level than the one specified can use the upper level course to count as credit towards the group award. For example, Technological Studies (AH) can be counted instead of Technological Studies (H).

Candidates can only use one of these courses to count as credit towards the group award - a maximum of 4 credits.

Standard Grades

D

Designated Standard Grades at Credit Level can each contribute 4 credits to the SGA in place of corresponding National Courses.

The designated Standard Grade and the corresponding National Courses, either of which can contribute to this SGA, is as follows:

Standard Grade*	**National Course**
Technological Studies at Credit Level	Technological Studies (Int 2)

*If achieved prior to 1994 please contact SQA Helpdesk ☎ 0141 242 2214.

SCE Highers

E

Designated SCE Highers can each contribute 4 credits to the SGA in place of corresponding National Courses.

The designated SCE Highers and their corresponding National Courses, either of which can contribute to this SGA, are as follows:

SCE Higher Grade*	**National Course**
Mathematics	Mathematics (H)
Technological Studies	Technological Studies (H)

*If achieved prior to 1994 please contact SQA Helpdesk ☎ 0141 242 2214.

SCE Highers do not give automatic certification of core skills. Further information will be published about this in due course**.**

SVQs

F

Relevant Scottish Vocational Qualifications (SVQs) can each contribute up to eight credits to an SGA.

SVQs at Level 3 contribute credits at Higher.
SVQs at Level 2 contribute credits at Intermediate 2.

In this particular SGA any SVQs from occupational area 004 (Engineering) can each contribute 7 credits. Specific SVQs from the following areas can each contribute 7 credits:

001 (Tending Animals, Plants and Land)
002 (Extracting and Providing Natural Resources)
005 (Manufacturing)
006 (Transporting)

Code no	Relevant SVQs	Level
001 Tending Animals, Plants and Land		
G3P0 23	Fishing Vessel Engineering	3
G311 22	Fishing Vessel Engineering	2
002 Extracting and Providing Natural Resources		
G3PY 23	Electricity Distribution and Transmission Engineering	3
G325 22	Electricity Distribution and Transmission Engineering	2
G324 22	Nuclear Decommissioning	2
G615 22	Operating Hydro Generation Systems	2
G31R 22	Operating Single Electricity Generation Systems	2
G3PS 23	Maintaining Electricity Generation Systems (Control and Instrumentation)	3
G3PH 23	Maintaining Electricity Generation Systems (Electrical)	3
G3PW 23	Maintaining Electricity Generation Systems (Electrical /Control and Instrumentation)	3
G3PR 23	Maintaining Electricity Generation Systems (Mechanical)	3
G3PV 23	Maintaining Electricity Generation Systems (Mechanical /Control and Instrumentation)	3
G3PT 23	Maintaining Electricity Generation Systems (Mechanical/Electrical)	3
G3PX 23	Maintaining Electricity Generation Systems (Mechanical/Electrical Control and Instrumentation)	3
G31W 22	Maintaining Electricity Generation Systems (Control and Instrumentation)	2
G31S 22	Maintaining Electricity Generation Systems (Electrical)	2
G320 22	Maintaining Electricity Generation Systems (Electrical /Control and Instrumentation)	2

Code no	Relevant SVQs	Level
002 Extracting and Providing Natural Resources		
G31V 22	Maintaining Electricity Generation Systems (Mechanical)	2
G31Y 22	Maintaining Electricity Generation Systems (Mechanical /Control and Instrumentation)	2
G31X 22	Maintaining Electricity Generation Systems (Mechanical/Electrical)	2
G321 22	Maintaining Electricity Generation Systems (Mechanical/Electrical/ Control and Instrumentation)	2
G3PK 23	Operating Multiple Electricity Generation Systems (Combined Heat and Power Systems (inc Gas Turbines)	3
G3PJ 23	Operating Multiple Electricity Generation Systems (Diesel Systems)	3
G3PG 23	Operating Multiple Electricity Generation Systems (Fossil-fired Systems)	3
G3PL 23	Operating Multiple Electricity Generation Systems (Hydro/pumped Storage Systems)	3
G3PM 23	Operating Multiple Electricity Generation Systems (Nuclear (Magnox) Systems)	3
G3PP 23	Operating Multiple Electricity Generation Systems (Nuclear (Pressurised Water Reactor) Systems	3
G3PN 23	Operating Multiple Electricity Generation Systems (Nuclear (Advanced Gas Reactor) Systems	3
004 Engineering		
G38G 22	Engineering Manufacture: Foundation	2
G5KY 22	Performing Engineering Operations	2
005 Manufacture		
G38J 22	Performing Manufacturing Operations	2
006 Transporting		
G5C3 23	Rail Transport Engineering: Maintenance (Communication Systems)	3
G5C5 23	Rail Transport Engineering: Maintenance (Electrification)	3
G5C4 23	Rail Transport Engineering: Maintenance (Permanent Way)	3
G5C7 23	Rail Transport Engineering: Maintenance (Plant)	3
G5C2 23	Rail Transport Engineering: Maintenance: (Signal Engineering)	3
G5C6 23	Rail Transport Engineering: Maintenance: (Traction and Rolling Stock)	3
G5C3 22	Rail Transport Engineering: Maintenance (Communication Systems)	2
G5C5 22	Rail Transport Engineering: Maintenance (Electrification)	2
G5C4 22	Rail Transport Engineering: Maintenance (Permanent Way)	2

Code no	Relevant SVQs	Level
006 Transporting (continued):		
G5C7 22	Rail Transport Engineering: Maintenance (Plant)	2
G5C2 22	Rail Transport Engineering: Maintenance (Signal Engineering)	2
G5C6 22	Rail Transport Engineering: Maintenance (Traction and Rolling Stock)	2
G5CB 22	Rail Transport Operations (Control Room Operations)	2
G5C8 22	Rail Transport Operations (Driving)	2
G5CC 22	Rail Transport Operations (Passenger Services)	2
G5C9 22	Rail Transport Operations (Shunting)	2
G5CA 22	Rail Transport Operations (Signal Operations)	2

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