Standard in development

L6: Robotics Engineer

Title of occupation

Robotics Engineer

UOS reference number

ST1317

Core and options

No

Option title/s

Level of occupation

Level 6

Route

Engineering and manufacturing

Typical duration of apprenticeship

48 months

Degree apprenticeship

integrated degree

Target date for approval

01/09/2022

Resubmission

No

Would your proposed apprenticeship standard replace an existing framework?

No

Does professional recognition exist for the occupation?

Yes

The apprenticeship standard will seek professional accreditation by IMechE and IET, IMechE has expressed support for the development of the robotics apprenticeship standard. The KSBs will be mapped in accordance to the Accreditation of Higher Education programmes (AHEP) guidance notes.

Occupation summary

This occupation is found in technology or engineering functions across a range of public and private sectors such as manufacturing, retail, healthcare and transportation, all of which range in size from large to small operations. Robotics engineers will normally operate with a considerable degree of autonomy and will lead teams that develop and deploy robotic systems. They work in accordance with applicable laws, regulations, standards and ethics.

The broad purpose of the occupation is to specify, design, build, program and test robotic systems or solutions intended to do automated jobs in industries including manufacturing, construction, logistics, aerospace and medicine, as well as robots that interact with people and operate autonomously in public spaces and warehouses

In their daily work, an employee in this occupation interacts with a multidisciplinary project team that can consist of process engineers, mechanical engineers, electrical engineers, software engineers, communication engineers, industrial psychologists, shop floor staff, safety engineers and other key stakeholders depending on the nature of the project. An employee in this occupation would typically report to a project manager and would have significant interaction with customers and stakeholders. The work locations could vary between office, shop floor, or other remote locations where the robotic systems are deployed.

An employee in this occupation will be responsible for the design, development, integration, programming and deployment of robotic systems with considerations to project timescales, milestones, safety regulations, ethical issues, sustainability, cost, reliability, maintenance, and implementation.

Typical job titles

Application engineer Design engineer Manufacturing engineer Mechatronic engineer Process engineer Production engineer Research engineer Robotics engineer

Are there any statutory/regulatory or other typical entry requirements?

No

Occupation duties

DUTY	KSBS
Duty 1 Plan and lead research activities to determine feasibility and	K1 K2 K3 K4 K5 K7 K8 K9 K10 K11 K12 K13 K14 K15 K16 K17 S1 S2 S3 S4 S6 S7 S9 S10 S11 S12 S15 S16 S18 S19 B1 B2 B3 B4 B5 B6 B7 B8

DUTY	KSBS
applicability of automation solutions.	
Duty 2 Identify constraints and capture technical requirements for robotics projects.	K1 K2 K3 K4 K5 K6 K7 K8 K9 K15 K17 S1 S3 S4 S5 S6 S7 S9 S10 S11 S12 S15 S16 S18 S19 B1 B2 B3 B4 B6 B7 B8
Duty 3 Design processes and parts using computer-aided design.	K1 K2 K3 K4 K5 K7 K8 K9 K10 K11 K12 K13 K14 S4 S5 S7 S8 S11 S12 S15 S16 S18 S19 B1 B2 B3 B4 B5 B6 B7 B8
Duty 4 Design sustainable robotic systems to fulfil customer and technical requirements.	K1 K2 K3 K4 K5 K6 K7 K8 K9 K10 K11 K12 K13 K14 K15 K16 K17 S1 S2 S3 S4 S5 S6 S7 S8 S9 S11 S12 S14 S15 S16 S18 S19 B1 B2 B3 B4 B5 B6 B7 B8
Duty 5 Create robotic systems that allow for ethical and safe interaction with human users.	K1 K5 K6 K7 K8 K9 K10 K11 K12 K13 K14 K17 S1 S2 S3 S4 S5 S6 S7 S8 S12 S14 S15 S18 S19 B1 B2 B3 B4 B5 B6 B7 B8
Duty 6 Develop and integrate human-robot interfaces that allow intuitive and immersive operation of robots by non-robotic-expert users.	K1 K2 K3 K4 K5 K6 K7 K8 K9 K10 K11 K12 K13 K14 K17 S2 S3 S4 S5 S12 S14 S15 S17 S18 S19 B1 B2 B3 B4 B5 B6 B7 B8
Duty 7 Analyse and optimise robot system performance using computer simulations.	K1 K2 K3 K4 K5 K7 K8 K9 K10 K11 K12 K13 K14 K17 S2 S3 S4 S5 S7 S8 S14 S15 S16 S18 S19 B1 B2 B3 B4 B5 B6 B7 B8
Duty 8 Build, integrate and test functional robot systems.	K1 K2 K3 K4 K5 K6 K7 K8 K9 K10 K11 K12 K13 K14 K15 K17 S2 S3 S4 S5 S6 S7 S8 S11 S12 S14 S15 S16 S18 S19 B1 B2 B3 B4 B5 B6 B7 B8
Duty 9 Collect and analyse data from robot sensors and cameras.	K9 K12 K13 S2 S3 S4 S18 S19 B2 B3 B4 B6 B7 B8
Duty 10 Integrate and programme robots to perform practical tasks for different working environments.	K1 K3 K4 K5 K6 K7 K8 K9 K10 K11 K12 K13 K14 K15 K17 S2 S3 S4 S5 S6 S7 S8 S14 S15 S16 S18 S19 B1 B2 B3 B4 B5 B6 B7 B8
Duty 11 Investigate and diagnose the root cause of faults and implement appropriate solutions.	K1 K2 K3 K4 K5 K7 K8 K9 K10 K11 K12 K13 K14 K15 K17 S2 S3 S4 S5 S6 S7 S8 S13 S15 S16 S18 S19 B1 B2 B3 B4 B5 B6 B7 B8

DUTY	KSBS
Duty 12 Undertake hazard identification, safety risk assessment and risk mitigation for automated processes.	K2 K5 K7 K8 K10 K11 K12 K13 K15 K17 S1 S2 S3 S4 S5 S6 S7 S8 S13 S15 S17 B1 B2 B3 B4 B6 B7 B8
Duty 13 Verify system safety compliance through liaison with accredited safety engineers.	K5 K7 K8 K10 K11 K12 K13 K15 K17 S1 S2 S3 S4 S6 S7 S8 S13 S15 S17 B1 B2 B3 B4 B6 B7 B8
Duty 14 Research new ways to use robots and artificial intelligence.	K1 K2 K3 K4 K5 K7 K8 K9 K10 K11 K12 K13 K14 K17 S1 S4 S5 S6 S7 S8 S15 S17 S18 S19 B1 B2 B3 B4 B6 B7 B8
Duty 15 Demonstrate finished products to customers and explain operating procedures.	K1 K2 K3 K4 K5 K7 K8 K9 K10 K11 K12 K13 K14 K17 S1 S2 S3 S4 S6 S7 S8 S9 S15 S18 S19 B1 B2 B3 B4 B6 B7 B8
Duty 16 Write technical reports and generate presentations on project progress, risks and issues.	K1 K2 K3 K4 K5 K7 K8 K9 K10 K11 K12 K13 K14 K16 K17 S1 S4 S9 S10 S13 S15 S16 S18 S19 B1 B2 B3 B4 B5 B6 B7 B8
Duty 17 Understand and account for human emotions such as trust, fear and acceptance in the design and implementation of new systems.	K1 K10 K11 K14 K17 S4 S5 S6 S7 S8 S13 S17 B1 B2 B3 B4 B5 B6 B7 B8

KSBs

Knowledge

K1: Principles of mechanical designs including material selection, manufacturing processes, robot types and configurations.
K2: Principles of engineering mathematics required to model robotic systems using advanced mathematical techniques.
K3: Principles of electronic engineering including networks and electronic circuit design.
K4: Principles of robotics control including kinematics, dynamics, robotics programming structure and control algorithms.
K5: Robot and computer program design, structure, concepts, compilers and logic, and programming languages for robotics applications.
K6: Principles of software engineering including object-orientated programming, software architecture, and version control.
K7: Principles of safety including safety standards, hazard identification, risk assessment and risk mitigation.
K8: Communication techniques and interface methods for the integration of robotic systems.

K9: Principles of computer and machine vision for robotics applications including 3D computer vision and point clouds.
K10: Human Factors principles for robotics applications including ergonomics, safety design, trust, acceptance, situational awareness, and workload.
K11: Principles of human-robot interaction including user-centred design, human-robot interface, human-computer interaction, human-robot collaboration and robot ethics.
K12: Artificial intelligence and machine learning algorithms and techniques for robotics applications.
K13: Autonomous systems design principles and techniques including perception, decision making, locomotion, robot ethics and navigation.
K14: System thinking for sustainability in robotics applications including energy management, waste reduction, and circular economy around the lifecycle of a project.
K15: Industrial research and strategy including factory planning, scheduling, processes, lean production and supply chain.
K16: Project management principles including planning, scheduling, budgeting, risk management and resource management.
K17: Communication techniques including oral, written, and presentations.

Skills

S1: Communicate and provide guidance to others through design models, reports, drawings, specifications, presentations, digital media and discussions.
S2: Manage different, competing interests within and outside the organisation using negotiation skills.
S3: Seek input from others to manage relationships.
S4: Apply analytical and critical thinking skills for technology solutions development.
S5: Analyse and apply structured problem solving techniques to systems and situations.
S6: Plan, lead and conduct industrial research using literature and other media.
S7: Design robotic processes with considerations to human factors, sustainability, and safety through modelling and using simulation tools.
S8: Produce robot design at component and system level using Computer Aided Design (CAD) and robot simulation.
S9: Generate and present business cases to support design decisions and to illustrate potential return on investment (ROI).
S10: Manage the planning, budgeting and organisation of tasks, people and resources through the use of management systems, work to agreed quality standards, project programmes and budgets, within legal, contractual and statutory requirements.
S11: Select appropriate components and vendors for robot system development.
S12: Manage project risks through risk identification, assessment, mitigation, and monitoring.
S13: Assess robot system safety compliance through hazard identification, safety risk assessment and risk mitigation, and liaison with certified safety engineers when required.
S14: Generate robot programmes to perform tasks.
S15: Apply system engineering techniques and software development methodologies and models in robot system development.
S16: Develop and test robotic systems through the integration of off-the-shelf or bespoke components as appropriate.
S17: Evaluate the suitability of robotic systems for human-robot interaction concerning human factors, safety, and ethics.
S18: Install and integrate sensors and instrumentation in robotic systems.

S19: Perform measurements and analyse data using measurement devices and analytical software

Behaviours

B1: Act as a role model and advocate for health and safety across the team.
B2: Act in a professional and ethical manner.
B3: Collaborate and promote teamwork across disciplines.
B4: Commit to their own and support others' professional development.
B5: Lead by example to promote innovation.
B6: Lead by example to promote accessibility, diversity and inclusion.
B7: Adapt and is resilient to challenging or changing situations.
B8: Act as a role model and advocate environmental and sustainable practices.

Qualifications

English & Maths

Apprentices without level 2 English and maths will need to achieve this level prior to taking the End-Point Assessment. For those with an education, health and care plan or a legacy statement, the apprenticeship's English and maths minimum requirement is Entry Level 3. A British Sign Language (BSL) qualification is an alternative to the English qualification for those whose primary language is BSL.

Does the apprenticeship need to include any mandated qualifications in addition to the above-mentioned English and maths qualifications?

Yes

Other mandatory qualifications

BEng Robotics Engineering

Level: 6 (integrated degree)

Additional information:

BEng Robotics

Level: 6 (integrated degree)

Additional information:

Consultation

Progression Routes

ST0456 Post graduate engineer L7
Robotics engineers could become lead engineers, with overall responsibility for managing a specific project. They could also specialise in a particular area of robotics, for example self-driving vehicles, space exploration, surgical instruments or deep ocean research.

Supporting uploads

Mandatory qualification uploads
ST1317_standard_hard_sift_evidence_Robotics Engineering Graduate Jobs.doc
Professional body confirmation uploads

Involved employers

Rockwell, Fanuc, ABB, The Manufacturing Technology Centre (MTC), SMC, Airbus, Leidos, Didactic (Festo), Hays, Extend Robotics, Ocado Technology, ARRIVAL Ltd, RAR UK, VW Group UK