12. Building services engineering (BSE) systems

Sample scheme of work

This sample scheme of work covers classroom-based learning for **Building services engineering (BSE) systems**. It is based on 45 hours of learning over 12 sessions. It is an example only of a possible scheme of work and is based on theory within an FE centre, but can be amended to suit all learning facilities with the necessary adjustments to meet individual learners' needs.

The technical qualification has been developed to include competency frameworks for T Levels, which demonstrate an array of competencies across maths, English and digital skills, as well as the core skills learners will need to use when they progress onwards from completing their T Level.

The Criteria column in the scheme of work identifies opportunities where these core skills can be developed and embedded into teaching and learning for each criterion. It is not expected that all criteria will develop core skills, but where these skills exist in the core content it has been referenced to support FE centres.

For more information on how the core skills can be evidenced, please refer to the Technical Qualification Specification (example below).

12.1 Building Services Engineering **systems**

What do learners need to learn?	Skills
The layout and basic components included in a range of BSE systems. What these systems are used for and when they are used. Key differences in operation and advantages and disadvantages of each system type. Integration between systems including common skills.	CSA CSB

You can use the sample scheme of work as it is, adjust it or extract content to create a scheme of work to suit your delivery needs. It can also be adjusted by adding theory and practical workshops to support learners who have/need additional learning time.

12. Building services engineering (BSE) systems

Sample scheme of work

Course/qualification: T Level Technical Qualification in Building Services Engineering for Construction (Level 3)
Tutor's name:

Number of sessions: 12 **Delivery hours**: 45 **Venue**: **Group**:

Criteria
12.1 Building services engineering systems
12.2 The potential effects on building performance during installation, commissioning and decommissioning of BSE systems
12.3 Mechanical principles of components
12.4 Electrotechnical principles of components
12.5 Electrical supply
12.6 Earthing arrangements
12.7 Cables, accessories and equipment used in older electrical installations
12.8 Pipework and ductwork, components and systems

Session	Criteria	Activities and resources	Skills check
1 3 hours	12.1 **Building services engineering systems** • Air conditioning systems. (Skills: CSA, CSB) (12.2 **The potential effects on building performance during installation,**	**Activities** • Tutor to introduce the criteria and explain that **12.2** will be addressed throughout the unit in relation to the different BSE systems covered. • Tutor to deliver **PowerPoint 1: Air conditioning systems**. • Facilitate classroom discussion on the operation of the various types of air conditioning system. • Learners to complete **Worksheet 1: Air conditioning components**.	Worksheet 1 Classroom discussion

Session	Criteria	Activities and resources	Skills check
	commissioning and decommissioning of BSE systems • The learning outcomes for criterion 12.2 are spread throughout the unit in relation to each specific BSE system. Learners will therefore acquire this knowledge cumulatively, over the course of the unit.)	• Ask learners to research examples of different plant arrangements for air conditioning systems. • Discuss the implications of installing or decommissioning air handling systems (consider the trades required, any effects on the environment, positive or negative, and the impact on the users of the building). **Resources** • **PowerPoint 1 Air conditioning systems** • **Worksheet 1**	
2 3 hours	**12.1 Building services engineering systems** • Electrotechnical systems. (Skills: CSA, CSB)	**Activities** • Tutor to introduce the criterion. • Tutor to deliver **PowerPoint 2: Electrotechnical systems**. • Facilitate classroom discussion on the operation of the various types of electrotechnical system. • Learners to complete **Worksheet 2: Electrotechnical systems**. • Discuss the implications of installing or decommissioning electrotechnical systems (consider the trades required, any effects on the environment, positive or negative, and the impact on the users of the building). Can learners think of any disadvantages of LED lighting replacing older systems? **Resources** • **PowerPoint 2 Electrotechnical systems** • **Worksheet 2** • https://advances.sciencemag.org/content/7/35/eabi8322 (discussion of effects of LED lighting on insects).	Worksheet 2 Classroom discussion

Session	Criteria	Activities and resources	Skills check
3 3 hours	**12.1 Building services engineering systems** • Gas systems. (Skills: CSA, CSB)	**Activities** • Tutor to introduce the criterion. • Tutor to deliver **PowerPoint 3: Gas systems**. • After classroom discussion, learners to complete **Worksheet 3: Components of a boiler**. • Tutor to emphasise the importance of safety in regard to gas systems before learners attempt **Worksheet 4: Tightness testing**. • Class to discuss any implications of the necessity always to use qualified gas operatives for any work on gas systems. • Discuss the implications of installing or decommissioning gas systems (consider the trades required, any effects on the environment, positive or negative, and the impact on the users of the building). This discussion can extend across this session and Sessions 4 and 5. **Resources** • **PowerPoint 3 Gas systems** • **Worksheet 3** • **Worksheet 4**	Worksheet 3 Worksheet 4 Classroom discussion
4 3 hours	**12.1 Building services engineering systems** • Heating systems: domestic. (Skills: CSA, CSB)	**Activities** • Tutor to introduce the criterion. • Tutor to deliver **PowerPoint 4: Domestic heating systems**. • After classroom discussion, learners to complete **Worksheet 5: Y- and S-plan systems**. • Continue the discussion of implications begun in Session 3 in light of what has been learned in this session. **Resources**	Worksheet 5 Classroom discussion

Session	Criteria	Activities and resources	Skills check
		• **PowerPoint 4 Domestic heating systems** • **Worksheet 5**	
5 3 hours	**12.1 Building services engineering systems** • Heating systems: commercial and industrial. (Skills: CSA, CSB)	**Activities** • Tutor to introduce the criterion. • Tutor to deliver **PowerPoint 5: Commercial and industrial heating systems**. • Discuss the principles of industrial and commercial heating systems with the group before asking them to complete **Worksheet 6: Heating systems quiz**. • Continue the discussion of implications from Session 4 in light of what has been learned in this session. **Resources** • **PowerPoint 5 Commercial and industrial heating systems** • **Worksheet 6**	Worksheet 6 Classroom discussion
6 3 hours	**12.1 Building services engineering systems** • Plumbing systems. (Skills: CSA, CSB)	**Activities** • Tutor to introduce the criterion. • Tutor to deliver **PowerPoint 6: Plumbing systems**. • Discuss the principles of hot and cold plumbing systems including pipework, connections, controls and types. • Learners to complete **Worksheet 7: Cold water systems**. • Discuss the implications of installing or decommissioning plumbing systems (trades required, effects on the environment, positive or negative, impact on users of the building). **Resources** • **PowerPoint 6 Plumbing systems**	Worksheet 7 Classroom discussion

Session	Criteria	Activities and resources	Skills check
		• **Worksheet 7**	

Session	Criteria	Activities and resources	Skills check
7 3 hours	12.1 **Building services engineering systems** • Protection systems. (Skills: CSA, CSB)	**Activities** • Tutor to introduce the criterion. • Tutor to deliver **PowerPoint 7: Protection systems**. • Discussion on the various types of protection system before learners are asked to complete **Worksheet 8: Protection systems**. • Class discussion on the implications of installing or decommissioning protection systems (trades required, impact on users of the building). Tutor should ensure the importance of regular maintenance of such systems is emphasised, in particular fire protection systems. **Resources** • **PowerPoint 7 Protection systems** • **Worksheet 8**	Worksheet 8 Classroom discussion
8 3 hours	12.1 **Building services engineering systems** • Refrigeration systems. (Skills: CSA, CSB)	**Activities** • Tutor to introduce the criterion. • Tutor to deliver **PowerPoint 8: Refrigeration systems**. • Learners to complete **Worksheet 9: Refrigeration systems**. • Refer learners back to **PowerPoint 1** for more information on air cooling, as required.	Worksheet 9 Classroom discussion

Session	Criteria	Activities and resources	Skills check
		• Discuss the implications of installing or decommissioning refrigeration systems (trades required, effects on the environment, positive or negative, impact on users of the building). **Resources** • **PowerPoint 8 Refrigeration systems** • **Worksheet 9** • PowerPoint 1	
9 3 hours	12.1 **Building services engineering systems** • Ventilation systems. (Skills: CSA, CSB)	**Activities** • Tutor to introduce the criterion. • Tutor to deliver **PowerPoint 9: Natural and mechanical ventilation systems**. • Classroom discussion should then lead to the completion of **Worksheet 10: Ventilation systems**. • Class to discuss the implications of installing or decommissioning ventilation systems (trades required, effects on the environment, positive or negative, impact on users of the building). **Resources** • **PowerPoint 9 Natural and mechanical ventilation systems** • **Worksheet 10**	Worksheet 10 Classroom discussion
10 6 hours	12.3 **Mechanical principles of components** 12.8 **Pipework and ductwork, components and systems**	**Activities** • Tutor to introduce the criteria. • Tutor to deliver **PowerPoint 10: Mechanical principles of components**. • Learners to complete **Worksheet 11: Mechanical principles**.	Worksheet 11 Worksheet 12 Classroom discussion

Session	Criteria	Activities and resources	Skills check
		• Tutor to deliver **PowerPoint 11: Pipework and ductwork**. • Learners to complete **Worksheet 12: Pipework and ductwork**. • Discuss the implications of the installation and decommissioning of pipework and ductwork systems. **Resources** • **PowerPoint 10 Mechanical principles of components** • **PowerPoint 11 Pipework and ductwork** • **Worksheet 11** • **Worksheet 12**	
11 6 hours	12.4 **Electrotechnical principles of components** 12.7 **Cables, accessories and equipment used in older electrical installations** (Skills: MC2, MC4)	**Activities** • Tutor to introduce the criteria. • Tutor to deliver **PowerPoint 12: Electrotechnical components**. • Learners to complete **Worksheet 13: Electrotechnical components**. • As part of the decommissioning element of this unit, tutor to deliver **PowerPoint 13: Outdated cables, accessories and equipment** and discuss the importance of updating systems. • Learners to complete **Worksheet 14: Cables and equipment in older electrical installations**. • Discuss the implications of installing or decommissioning electrotechnical and associated cabling systems (trades required, effects on the environment, positive or negative, impact on users of the building). **Resources** • **PowerPoint 12 Electrotechnical components** • **PowerPoint 13 Outdated cables, accessories and equipment**	Worksheet 13 Worksheet 14 Classroom discussion

Session	Criteria	Activities and resources	Skills check
		• **Worksheet 13** • **Worksheet 14**	
12 6 hours	**12.5 Electrical supply** **12.6 Earthing arrangements** • At the conclusion of the second part of Session 12 time should be allowed for students to complete the multiple choice questions, with feedback either during the session or at a later date (if given as 'homework').	**Activities** • Tutor to introduce the criteria. • Tutor to deliver **PowerPoint 14: Electrical supply**. • Learners to complete **Worksheet 15: Electrical supply**. • Tutor to deliver **PowerPoint 15: Earthing arrangements**. • Learners to complete **Worksheet 16: Earthing arrangements**. • Discuss the implications of installing or decommissioning electrical supply and earthing systems (trades required, effects on the environment, positive or negative, impact on users of the building). • Tutor to conclude the final session of the unit (general discussion of content, Q&A etc). **Resources** • **PowerPoint 14 Electrical supply** • **PowerPoint 15 Earthing arrangements** • **Worksheet 15** • **Worksheet 16** • **Multiple choice questions**	Worksheet 15 Worksheet 16 Classroom discussion