

MAINTENANCE AND ENGINEERING | COURSE BROCHURE

Power Factor Correction and Harmonics

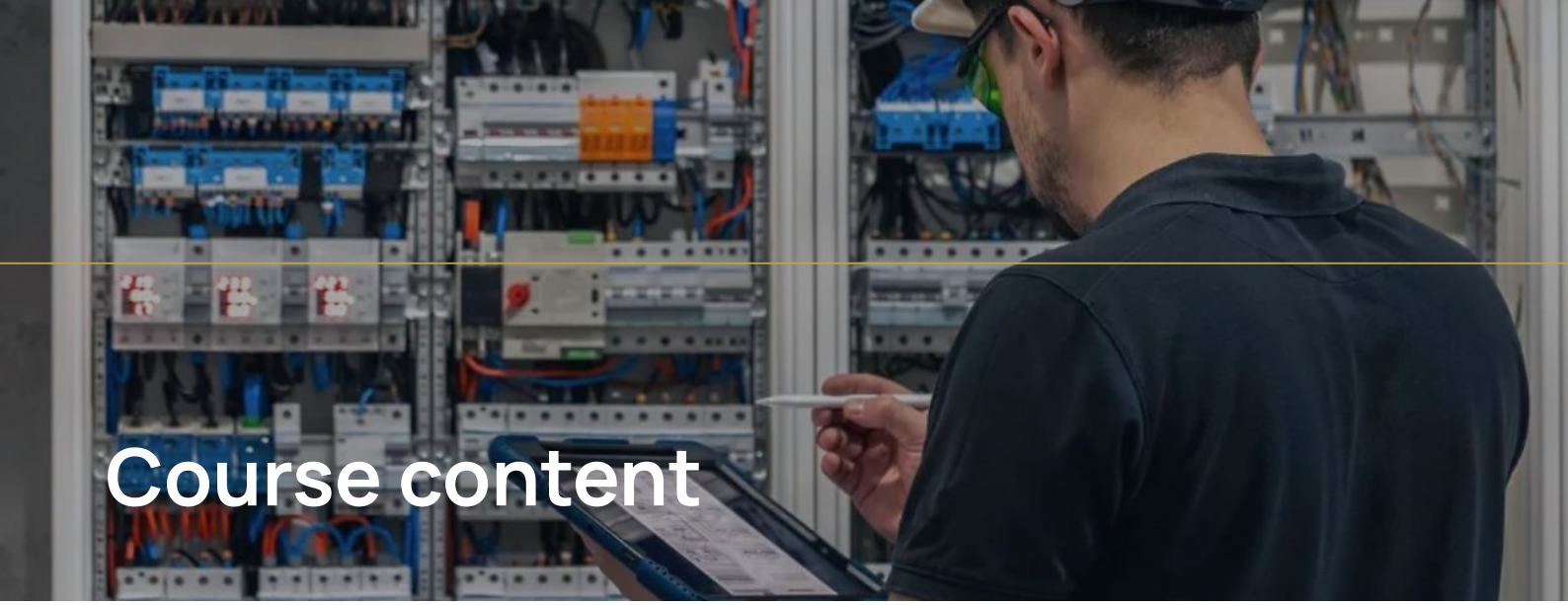
5 days | Classroom training | English

SMART HORIZON

info@smart-horizon.eu
2 Kingdom Street, Paddington
London W2 6BD, United Kingdom

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Course content

Why attend

This course provides a comprehensive understanding of power factor correction and harmonics in electrical systems. Participants will learn to analyse power quality issues, implement correction techniques, and assess harmonic distortion impacts, enhancing their ability to optimise energy efficiency and system reliability in their organisations.

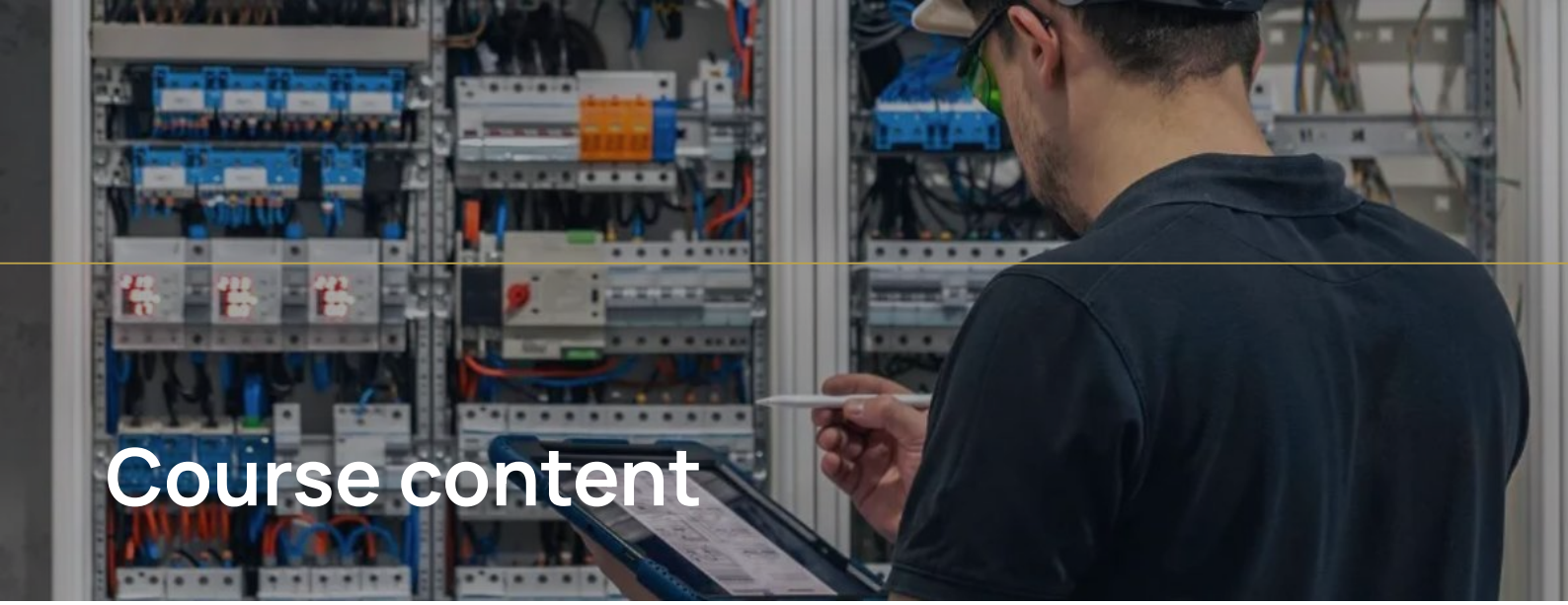
Electrical engineers and energy managers frequently encounter challenges related to power factor and harmonics, which can lead to increased operational costs, equipment failures, and regulatory non-compliance. Understanding these concepts is essential for ensuring efficient energy usage, maintaining system reliability, and enhancing overall operational efficiency. This course addresses these critical issues, equipping participants with the skills to identify, analyse, and rectify power quality problems effectively. They will also learn to make informed decisions regarding equipment upgrades and maintenance strategies, which are vital for enhancing system performance and compliance with industry standards. Participants will engage in practical exercises that simulate real-world scenarios, enabling them to apply theoretical knowledge to hands-on tasks. They will learn to design and implement power factor correction strategies, assess harmonic distortion, and make informed decisions regarding equipment selection and system upgrades. By the end of the course, participants will be equipped to develop comprehensive power quality management plans that enhance energy efficiency and prolong equipment lifespan. This capability is crucial for ensuring they can effectively contribute to their organisations' operational success and sustainability while minimising costs and maximising performance.

Professional Problems This Course Is Designed to Solve

- Poor power factor and inefficient use of electrical capacity.
- Harmonic distortion affecting equipment and power quality.
- Difficulty assessing suitable correction and mitigation measures.

Course methodology

The course employs a mix of theoretical instruction, case studies, and practical workshops to build participants' capabilities. Each day includes hands-on exercises where participants will analyse power factor and harmonic data, design correction solutions, and simulate real-world scenarios. Outputs include detailed reports and system designs that demonstrate their understanding and application of the concepts learned. Participants will also engage in group discussions and presentations to enhance collaborative learning and critical thinking skills. These methods ensure that participants not only grasp theoretical concepts but also gain practical experience in addressing power quality challenges in their workplaces, preparing them for immediate application of their skills.



Course content

Course objectives

By the end of this course, participants will be able to:
• Analyse power factor data to identify correction needs and potential savings.
• Calculate the required capacitance for power factor correction in specific scenarios.
• Diagnose harmonic distortion levels using measurement tools and techniques.
• Design a power factor correction system tailored to a given electrical load.
• Assess the impact of harmonics on equipment performance and lifespan.
• Justify the selection of specific harmonic filters based on system requirements.

Target audience

This course is suitable for:
• Electrical engineers responsible for power quality management.
• Energy managers tasked with reducing operational costs.
• Facility managers overseeing electrical system performance.
• Technicians involved in the installation and maintenance of electrical systems.

Target competencies

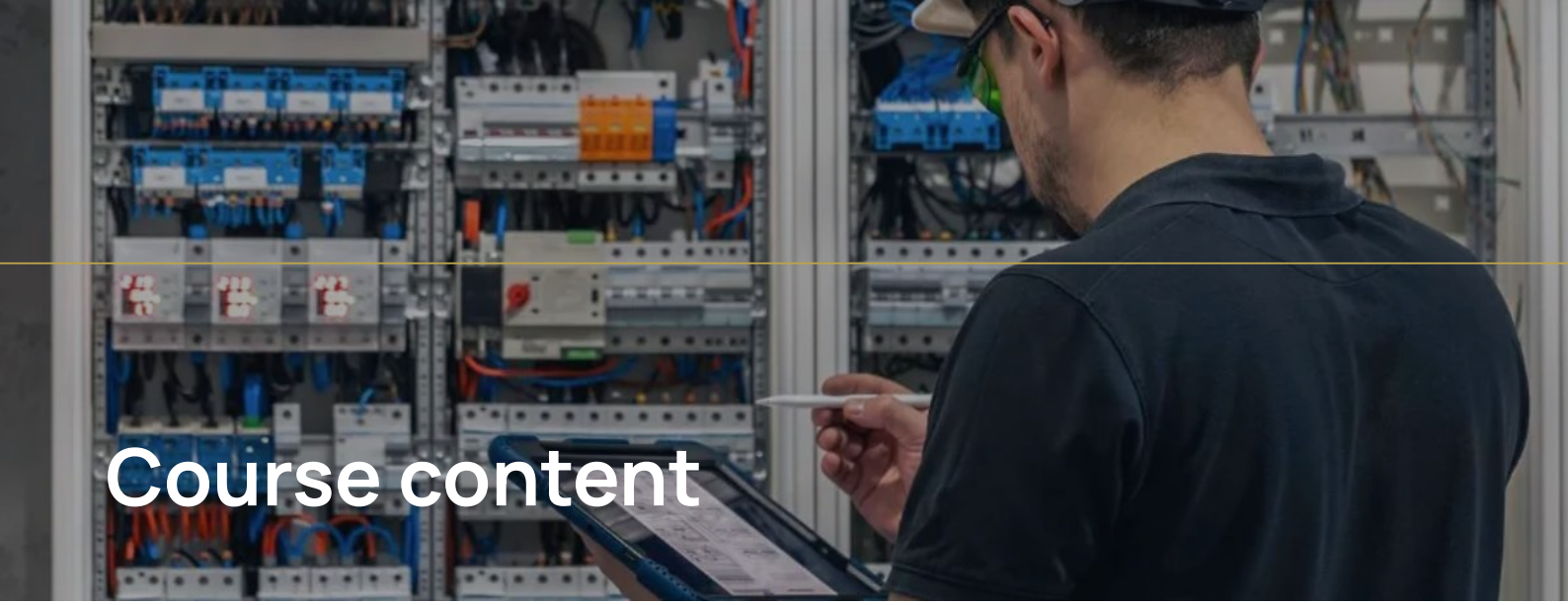
Participants will develop competencies in:
• Ability to analyse power factor and harmonic data accurately.
• Proficiency in calculating capacitance for power factor correction.
• Skill in diagnosing and measuring harmonic distortion.
• Competence in designing effective power factor correction systems.
• Capability to assess the impact of harmonics on electrical equipment.
• Expertise in selecting appropriate harmonic filters for specific applications.

Course outline

Day 1: Understanding Power Factor and Harmonics

Applied activity: Participants will analyse a case study of a facility with low power factor and high harmonic distortion. They will identify the causes and suggest initial corrective measures based on the data provided, including potential financial impacts and compliance issues.
Output: A report detailing the analysis, proposed corrective measures, and expected outcomes.

09:00–09:54	Define power factor and its significance in electrical systems, including its role in energy efficiency and cost reduction.



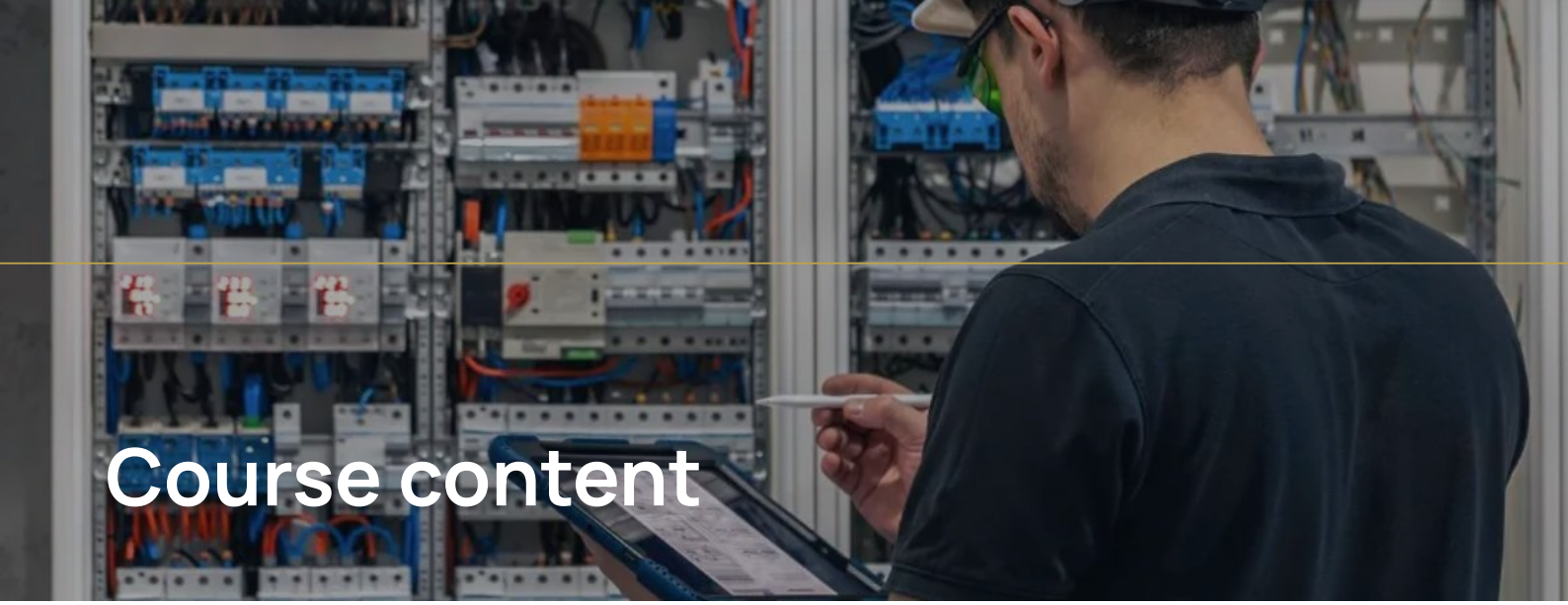
Course content

09:54–10:48	Identify the causes and effects of low power factor on operational costs, equipment lifespan, and system reliability.
10:48–11:00	Explain the concept of harmonics, their sources, and their impact on power quality and system performance.
11:00–11:30	**Coffee break**
11:30–12:12	Explain the concept of harmonics, their sources, and their impact on power quality and system performance. (continued)
12:12–13:06	Discuss the implications of harmonics on electrical equipment, including overheating, operational inefficiencies, and premature failure.
13:06–14:00	Introduce relevant standards and regulations regarding power factor and harmonics, such as IEEE 519 and IEC 61000.

Day 2: Measurement and Analysis Techniques

Applied activity: Using provided measurement data, participants will conduct a power factor analysis and harmonic distortion assessment on a simulated electrical system. They will present their findings, including recommendations for improvement and potential cost savings.
Output: A presentation summarising the analysis, findings, and recommendations for corrective actions.

09:00–09:54	Explore tools and techniques for measuring power factor and harmonics, including power quality analyzers and oscilloscopes.
09:54–10:48	Learn to interpret data from power quality analyzers and understand measurement accuracy and limitations.
10:48–11:00	Conduct a power factor analysis on a sample electrical system, identifying key metrics and areas for improvement.
11:00–11:30	**Coffee break**
11:30–12:12	Conduct a power factor analysis on a sample electrical system, identifying key metrics and areas for improvement. (continued)
12:12–13:06	Assess harmonic distortion using Fourier analysis methods and discuss their relevance in practical applications.
13:06–14:00	Review case studies of measurement results and corrective actions taken in various industries to enhance understanding.



Course content

Day 3: Designing Power Factor Correction Systems

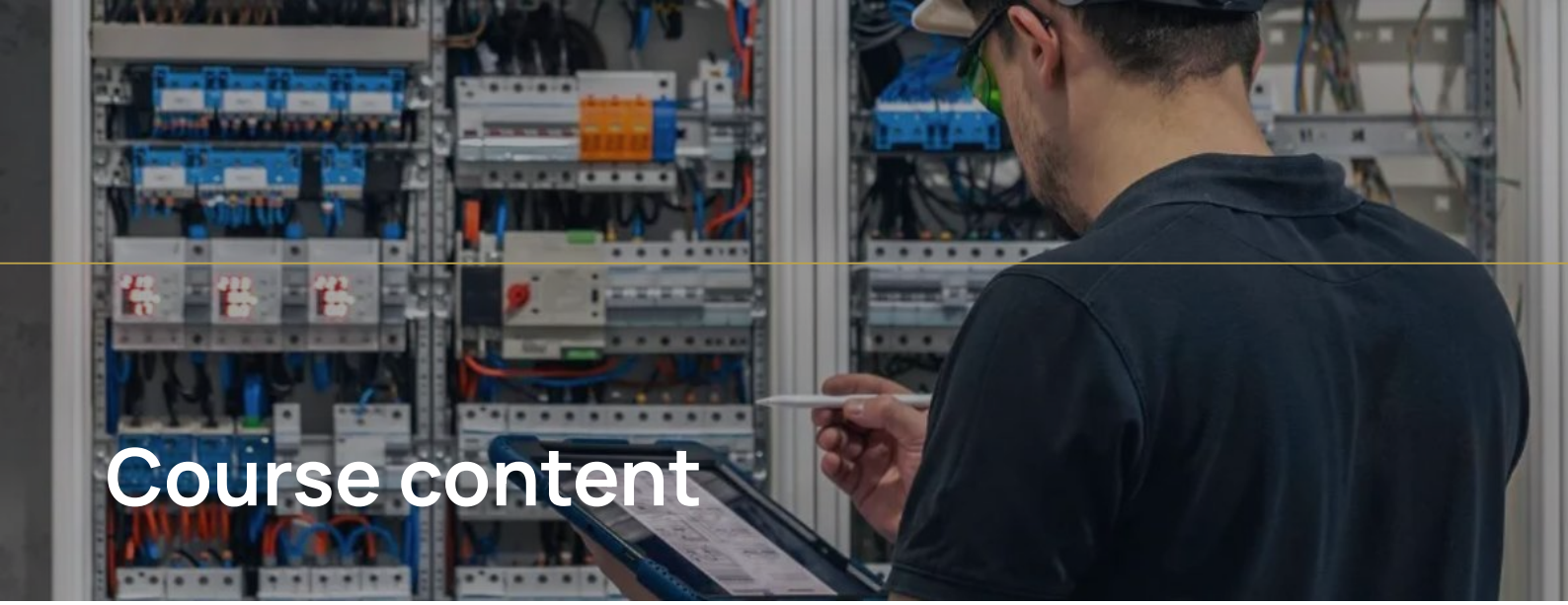
Applied activity: Participants will design a power factor correction system for a fictional manufacturing facility, considering load characteristics, operational costs, and regulatory compliance. They will present their designs to the group for feedback and discussion.
Output: A detailed design document outlining the correction system specifications, including calculations and justifications.

09:00–09:54	Understand different methods of power factor correction, including passive and active techniques, and their applications.
09:54–10:48	Calculate the required capacitance for various loads, considering different operational scenarios and load types.
10:48–11:00	Design a power factor correction scheme for a given scenario, including component selection and system integration.
11:00–11:30	**Coffee break**
11:30–12:12	Design a power factor correction scheme for a given scenario, including component selection and system integration. (continued)
12:12–13:06	Evaluate the cost-benefit of implementing correction systems based on energy savings, equipment longevity, and operational efficiency.
13:06–14:00	Discuss maintenance considerations for power factor correction equipment and their impact on system performance and reliability.

Day 4: Harmonic Mitigation Strategies

Applied activity: Participants will develop a harmonic mitigation strategy for a fictional commercial building, considering existing equipment, load profiles, and regulatory requirements. They will justify their choices based on technical and economic factors, preparing for stakeholder presentation.
Output: A comprehensive strategy document including filter specifications, implementation steps, and expected outcomes.

09:00–09:54	Identify various harmonic mitigation techniques and devices, including passive filters, active filters, and hybrid solutions, and their effectiveness.
09:54–10:48	Evaluate the effectiveness of passive and active filters in different applications and scenarios, considering cost and performance.
10:48–11:00	Design a harmonic filter solution for a specific application, considering load profiles, system characteristics, and regulatory requirements.
11:00–11:30	**Coffee break**



Course content

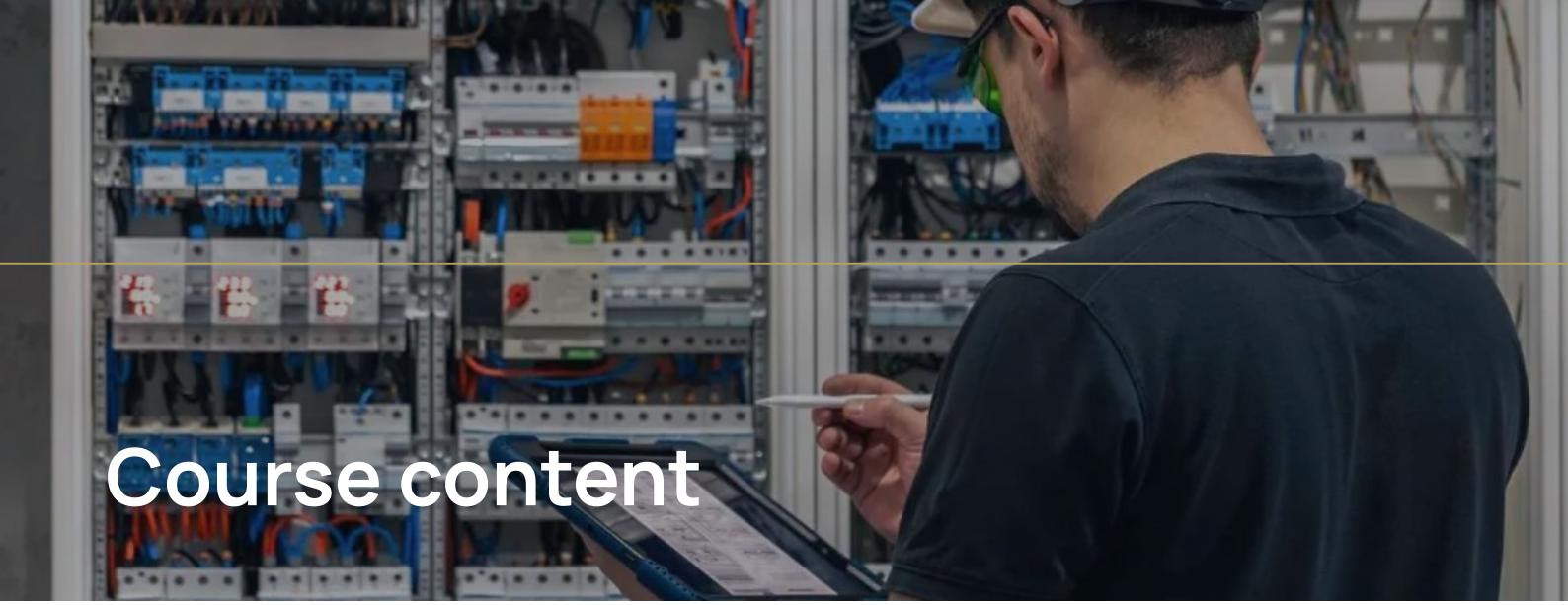
11:30–12:12	Design a harmonic filter solution for a specific application, considering load profiles, system characteristics, and regulatory requirements. (continued)
12:12–13:06	Discuss the integration of harmonic mitigation with power factor correction and its benefits for overall system performance.
13:06–14:00	Review case studies on successful harmonic mitigation implementations and lessons learned to inform best practices.

Day 5: Integrated Power Quality Solutions

Applied activity: Working in groups, participants will create an integrated power quality management plan for a complex facility, addressing both power factor and harmonic issues. They will present their plan to a mock board of directors for approval, incorporating feedback mechanisms.
Output: A complete power quality management plan ready for presentation, including detailed analysis, recommendations, and implementation strategies.

09:00–09:54	Combine power factor correction and harmonic mitigation strategies into a cohesive approach for optimal system performance.
09:54–10:48	Assess the overall impact of solutions on system efficiency and reliability, including potential cost savings and compliance with standards.
10:48–11:00	Conduct a feasibility study for implementing integrated solutions in a given scenario, addressing challenges and opportunities in execution.
11:00–11:30	**Coffee break**
11:30–12:12	Conduct a feasibility study for implementing integrated solutions in a given scenario, addressing challenges and opportunities in execution. (continued)
12:12–13:06	Discuss real-world challenges and solutions in power quality management, including stakeholder engagement and communication strategies.
13:06–14:00	Present integrated solutions to stakeholders effectively, highlighting benefits, justifications, and implementation timelines.

The timings provided are estimates and may vary depending on the number of participants and the discussions taking place during the sessions. They are indicative only and do not constitute a binding commitment.

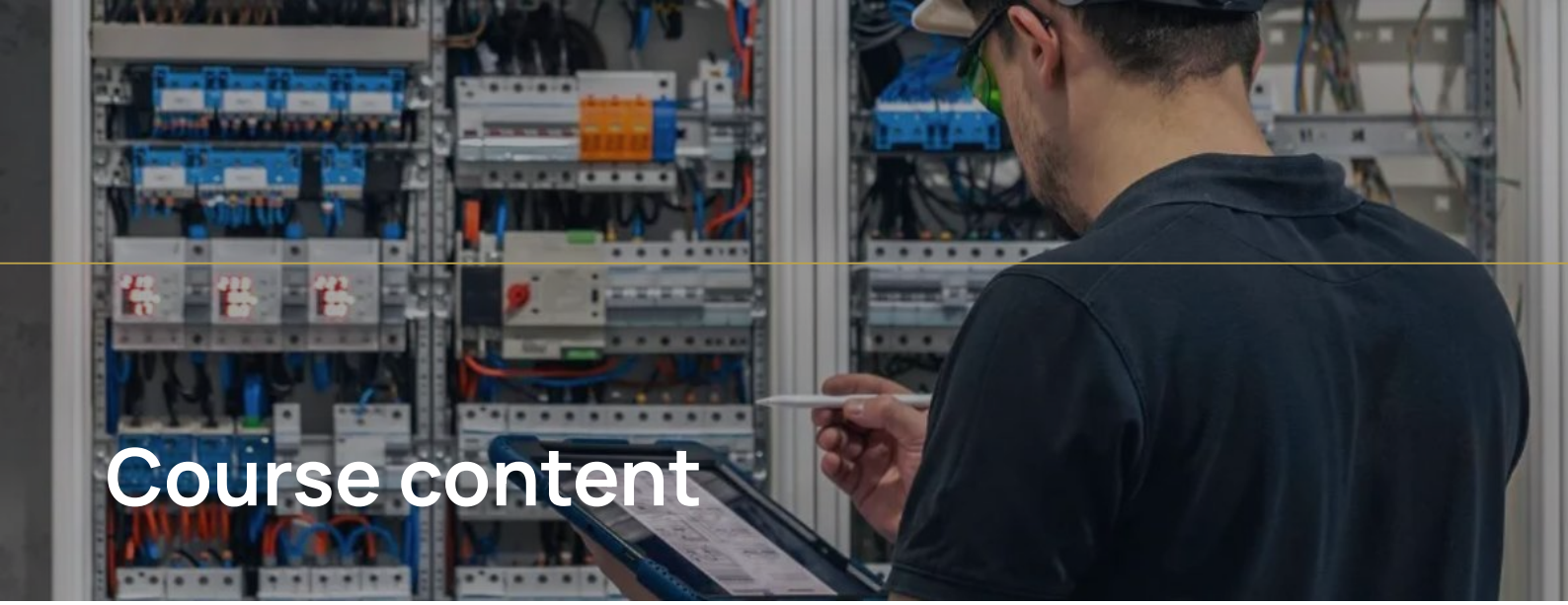


Course content

Dates, venues and fees

Current published course plans. Fees are per participant in GBP, excluding unconfirmed taxes.

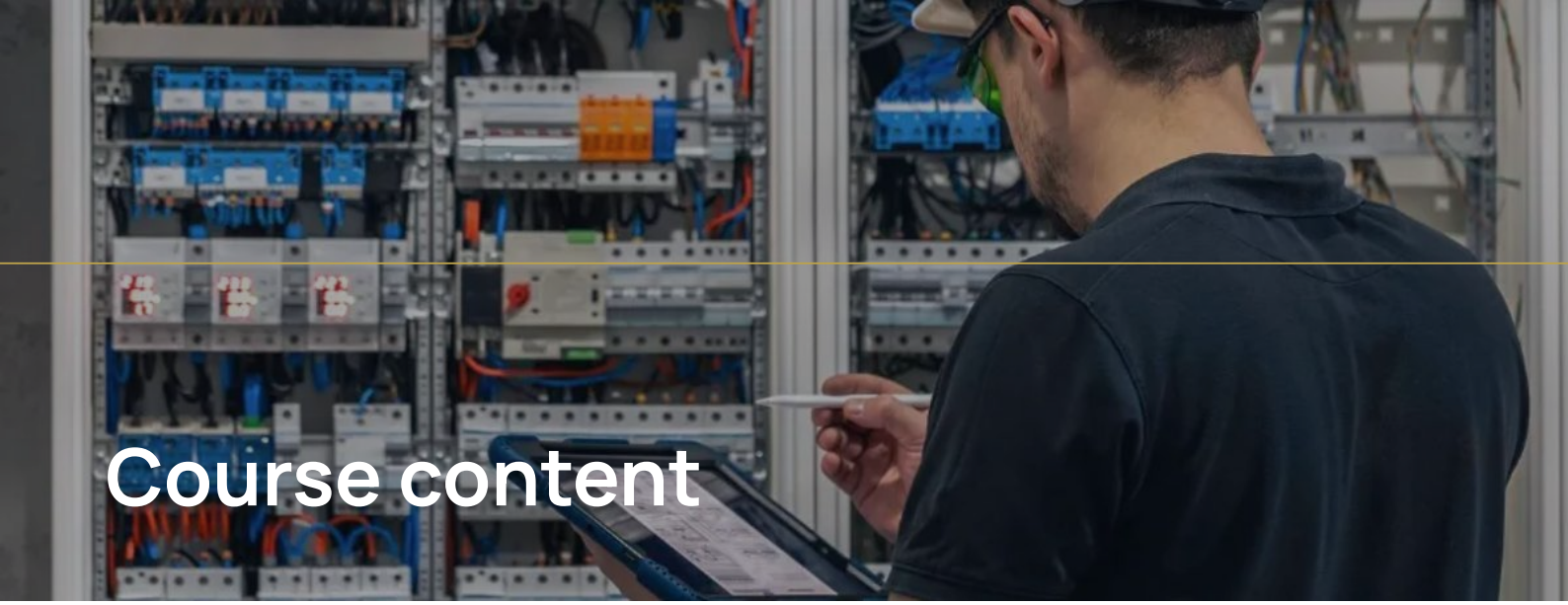
Venue	Start date	End date	Fee (GBP)
Kuala Lumpur Confirmed dates	16 Nov 2026	20 Nov 2026	**£2,900.–**
Online Confirmed dates	16 Nov 2026	20 Nov 2026	**£1,250.–**
Rome Confirmed dates	23 Nov 2026	27 Nov 2026	**£4,900.–**
Online Confirmed dates	23 Nov 2026	27 Nov 2026	**£1,250.–**
Paris Confirmed dates	7 Dec 2026	11 Dec 2026	**£5,720.–**
Online Confirmed dates	7 Dec 2026	11 Dec 2026	**£1,250.–**
Istanbul Confirmed dates	14 Dec 2026	18 Dec 2026	**£5,300.–**
Online Confirmed dates	14 Dec 2026	18 Dec 2026	**£1,250.–**
Amsterdam Confirmed dates	4 Jan 2027	8 Jan 2027	**£5,080.–**



Course content

Dates, venues and fees (continued)

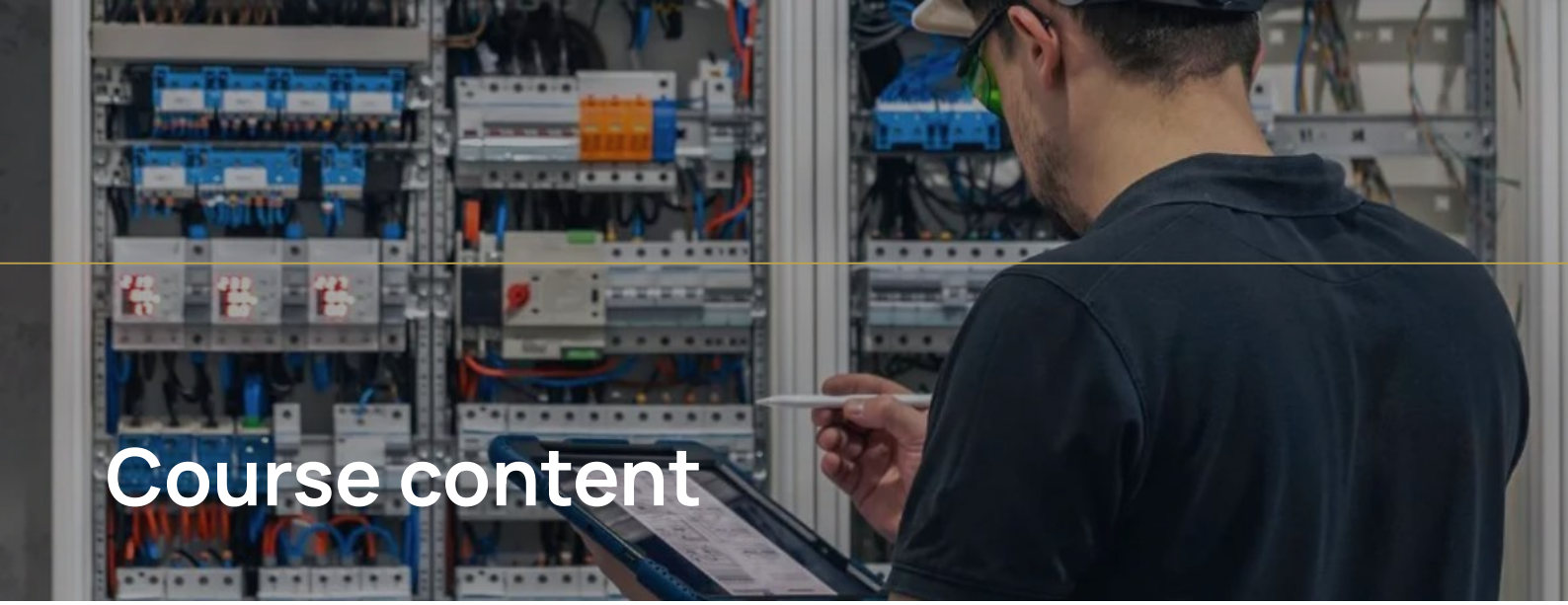
Venue	Start date	End date	Fee (GBP)
Online Confirmed dates	4 Jan 2027	8 Jan 2027	**£1,250.-**
Singapore Confirmed dates	18 Jan 2027	22 Jan 2027	**£5,640.-**
Online Confirmed dates	18 Jan 2027	22 Jan 2027	**£1,250.-**
London Confirmed dates	1 Feb 2027	5 Feb 2027	**£4,900.-**
Online Confirmed dates	1 Feb 2027	5 Feb 2027	**£1,250.-**
Cape Town Confirmed dates	8 Feb 2027	12 Feb 2027	**£3,780.-**
Online Confirmed dates	8 Feb 2027	12 Feb 2027	**£1,250.-**
Dubai Confirmed dates	15 Feb 2027	19 Feb 2027	**£6,300.-**
Online Confirmed dates	15 Feb 2027	19 Feb 2027	**£1,250.-**



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Dates, venues and fees (continued)

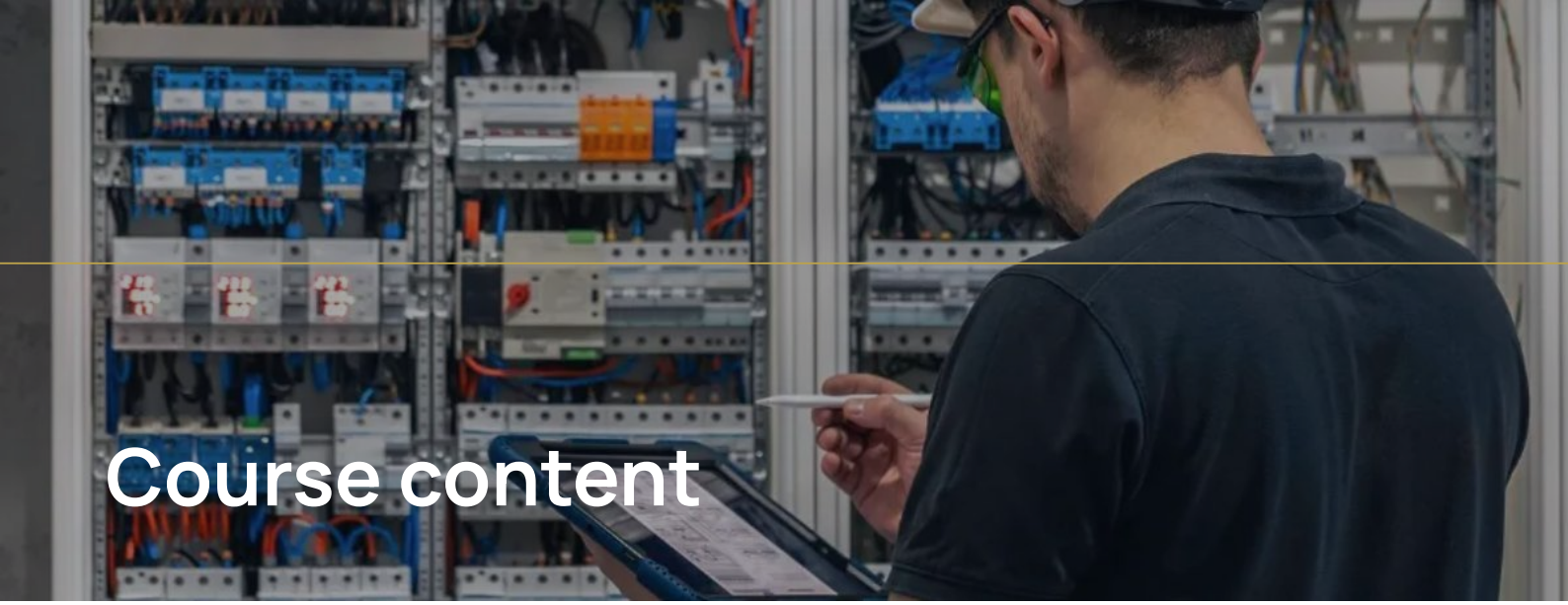
Venue	Start date	End date	Fee (GBP)
Frankfurt Confirmed dates	1 Mar 2027	5 Mar 2027	**£5,300.–**
Online Confirmed dates	1 Mar 2027	5 Mar 2027	**£1,250.–**
Kuala Lumpur Confirmed dates	15 Mar 2027	19 Mar 2027	**£2,900.–**
Online Confirmed dates	15 Mar 2027	19 Mar 2027	**£1,250.–**
Paris Confirmed dates	5 Apr 2027	9 Apr 2027	**£5,720.–**
Online Confirmed dates	5 Apr 2027	9 Apr 2027	**£1,250.–**
Cape Town Confirmed dates	12 Apr 2027	16 Apr 2027	**£3,780.–**
Online Confirmed dates	12 Apr 2027	16 Apr 2027	**£1,250.–**
Istanbul Confirmed dates	19 Apr 2027	23 Apr 2027	**£5,300.–**



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Dates, venues and fees (continued)

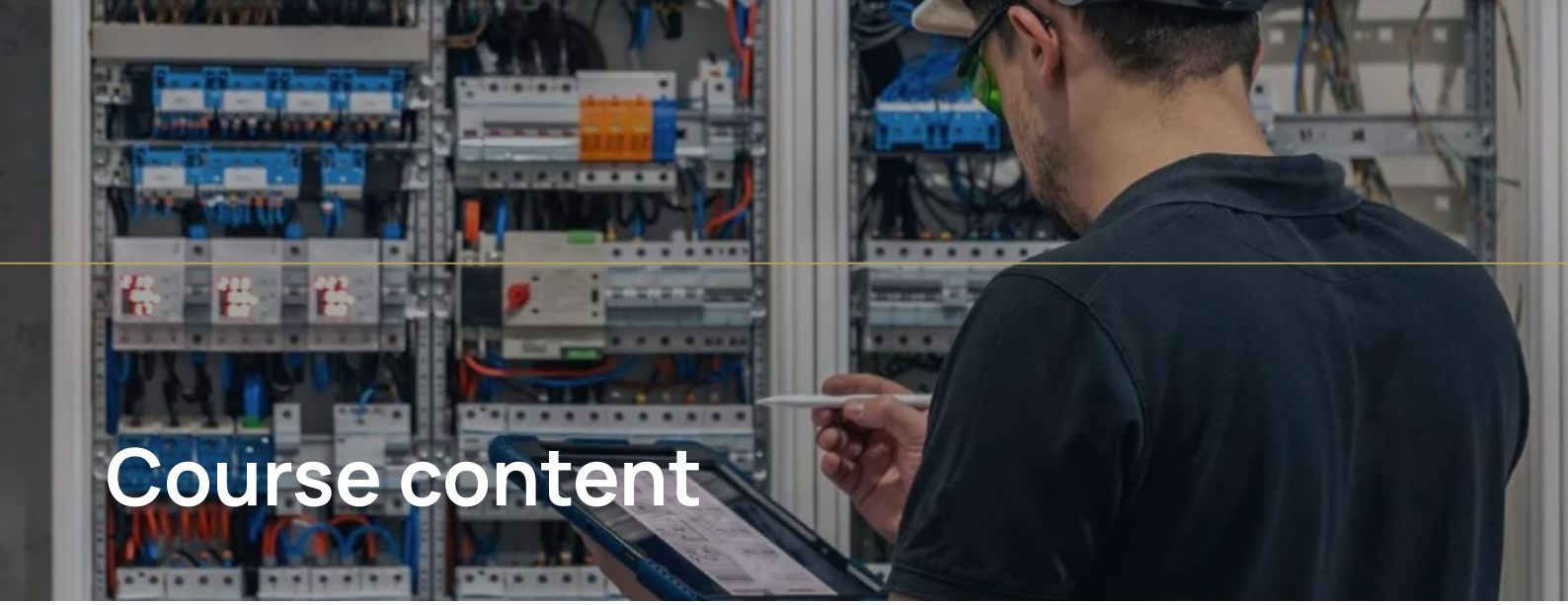
Venue	Start date	End date	Fee (GBP)
Online Confirmed dates	19 Apr 2027	23 Apr 2027	**£1,250.-**
Amsterdam Confirmed dates	3 May 2027	7 May 2027	**£5,080.-**
Online Confirmed dates	3 May 2027	7 May 2027	**£1,250.-**
Singapore Confirmed dates	17 May 2027	21 May 2027	**£5,640.-**
Online Confirmed dates	17 May 2027	21 May 2027	**£1,250.-**
London Confirmed dates	7 Jun 2027	11 Jun 2027	**£4,900.-**
Online Confirmed dates	7 Jun 2027	11 Jun 2027	**£1,250.-**
Barcelona Confirmed dates	14 Jun 2027	18 Jun 2027	**£5,680.-**
Online Confirmed dates	14 Jun 2027	18 Jun 2027	**£1,250.-**



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Dates, venues and fees (continued)

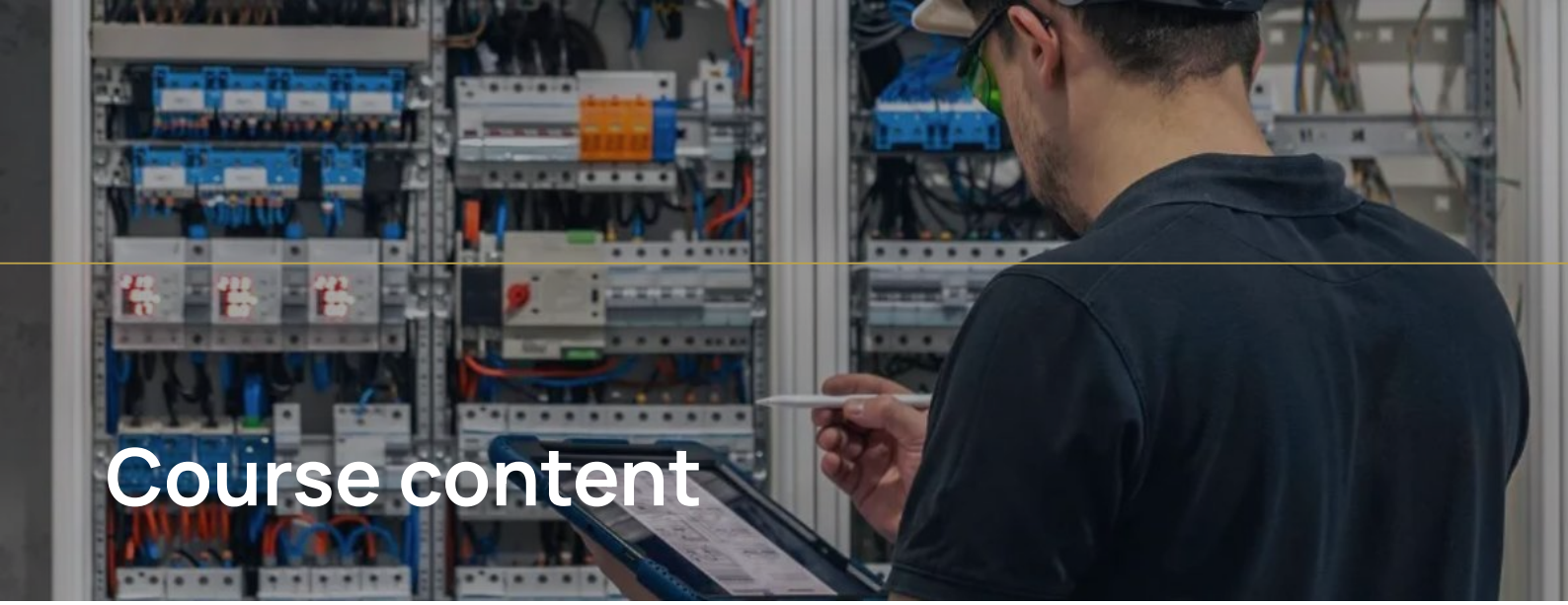
Venue	Start date	End date	Fee (GBP)
Dubai Confirmed dates	21 Jun 2027	25 Jun 2027	**£6,300.-**
Online Confirmed dates	21 Jun 2027	25 Jun 2027	**£1,250.-**
Frankfurt Confirmed dates	5 Jul 2027	9 Jul 2027	**£5,300.-**
Online Confirmed dates	5 Jul 2027	9 Jul 2027	**£1,250.-**
Kuala Lumpur Confirmed dates	19 Jul 2027	23 Jul 2027	**£2,900.-**
Online Confirmed dates	19 Jul 2027	23 Jul 2027	**£1,250.-**
Paris Confirmed dates	2 Aug 2027	6 Aug 2027	**£5,720.-**
Online Confirmed dates	2 Aug 2027	6 Aug 2027	**£1,250.-**
Istanbul Confirmed dates	16 Aug 2027	20 Aug 2027	**£5,300.-**



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Dates, venues and fees (continued)

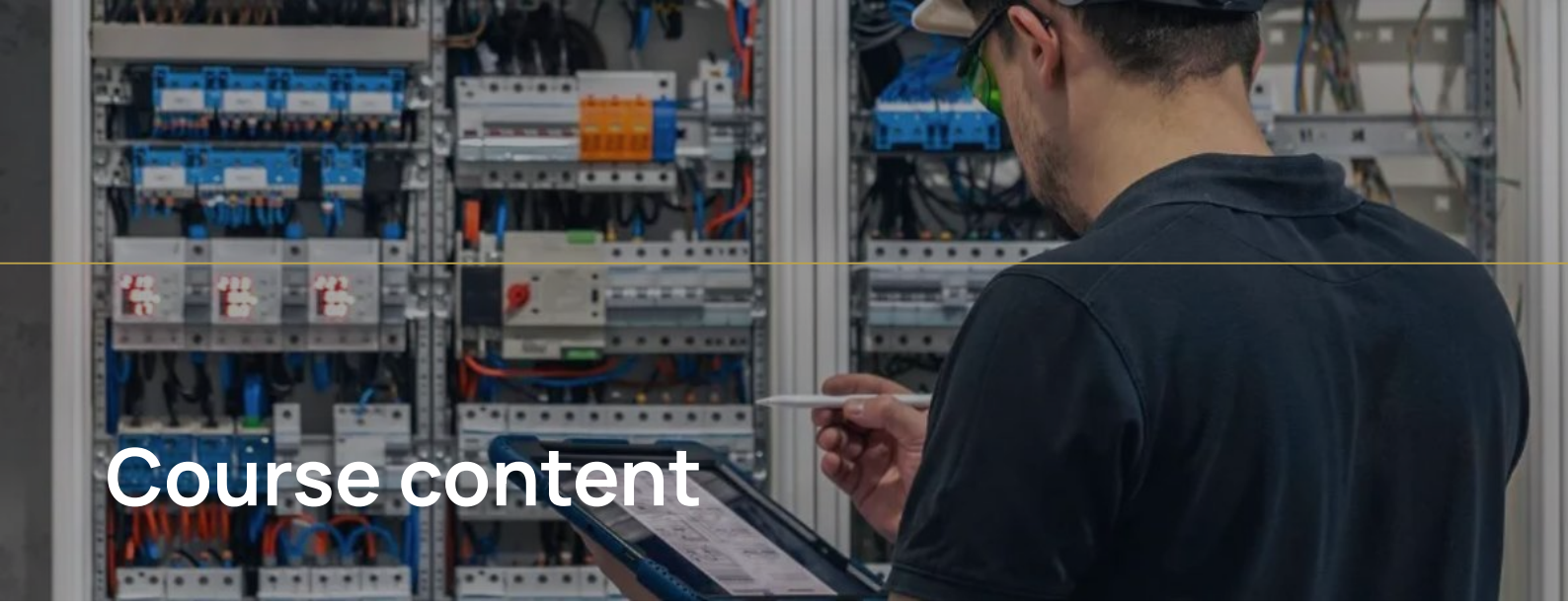
Venue	Start date	End date	Fee (GBP)
Online Confirmed dates	16 Aug 2027	20 Aug 2027	**£1,250.-**
Vienna Confirmed dates	23 Aug 2027	27 Aug 2027	**£5,880.-**
Online Confirmed dates	23 Aug 2027	27 Aug 2027	**£1,250.-**
Amsterdam Confirmed dates	6 Sept 2027	10 Sept 2027	**£5,080.-**
Online Confirmed dates	6 Sept 2027	10 Sept 2027	**£1,250.-**
Singapore Confirmed dates	20 Sept 2027	24 Sept 2027	**£5,640.-**
Online Confirmed dates	20 Sept 2027	24 Sept 2027	**£1,250.-**
London Confirmed dates	4 Oct 2027	8 Oct 2027	**£4,900.-**
Online Confirmed dates	4 Oct 2027	8 Oct 2027	**£1,250.-**



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Dates, venues and fees (continued)

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Rome Confirmed dates	25 Oct 2027	29 Oct 2027	**£4,900.–**
Online Confirmed dates	25 Oct 2027	29 Oct 2027	**£1,250.–**
Frankfurt Confirmed dates	1 Nov 2027	5 Nov 2027	**£5,300.–**
Online Confirmed dates	1 Nov 2027	5 Nov 2027	**£1,250.–**
Kuala Lumpur Confirmed dates	15 Nov 2027	19 Nov 2027	**£2,900.–**
Online Confirmed dates	15 Nov 2027	19 Nov 2027	**£1,250.–**
Paris Confirmed dates	6 Dec 2027	10 Dec 2027	**£5,720.–**



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Dates, venues and fees (continued)

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Online Confirmed dates	6 Dec 2027	10 Dec 2027	**£1,250.-**
Istanbul Confirmed dates	13 Dec 2027	17 Dec 2027	**£5,300.-**
Online Confirmed dates	13 Dec 2027	17 Dec 2027	**£1,250.-**

Plan your next step

Dates, availability, exact venue, taxes, inclusions and payment terms require written confirmation. This brochure is not a quotation, registration, booking confirmation or visa invitation. Participants receive a Smart Horizon UK certificate of attendance; programmes are not externally accredited and do not award a professional qualification or designation. Confirm arrangements before booking travel.

For group or in-house training, contact our learning team to discuss your objectives and delivery arrangements.

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