CAPITOLINE
DATA CENTRES AND IT INFRASTRUCTURE

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Data Centre Design DCD-10

Lesson plan

Session	Contents	Class activities
Introduction Day 1 0900 -1000	➢ Introduction to the subject ➢ Pressures on the computer room environment ➢ National and International standards e.g. TIA 942, EN 5017, BICSI 002 and ASHRAE ➢ Market size and dynamics ➢ Useful sources of information ➢ Introduction the TIA and TUI Tiering system ➢ Example project costs	
Green Metrics Day 1 1000-1030	➢ PUE and DCiE ➢ The Green Grid ➢ Energy Star ➢ LEED/BREEAM schemes ➢ US Environmental Protection Agency ➢ EU Code of Conduct & Best Practice ➢ TUI and CADE ➢ Power and CO_2 relationships	
Data Centre spaces Day 1 1045 - 1130	➢ Ideal locations ➢ Engineered spaces needed for a data centre ➢ Architectural requirements ➢ Sizing the computer room from an IT requirement ➢ Calculating floor strength ➢ Room heights ➢ Access and DDA requirements ➢ Fire escapes and emergency lighting ➢ Other facilities management issues	Exercise 1 *Biochem plc* location issues Exercise 2 *Biochem plc* space planning exercise
Raised access floors Day 1 1130-1145	➢ Calculating floor strength ➢ Distributed and point loads ➢ Standards ➢ Correct sealing ➢ Calculating floor heights ➢ Zinc whisker contamination	
Racks and location Day 1 1145-1230	➢ Hot and cold aisle concept ➢ 7 and 8 tile pitch models ➢ Server and communications racks ➢ 2 and 4 post designs ➢ Bad layout examples	Exercise 3 *Biochem plc* optimal rack layout in computer room
Cooling IT equipment Day 1 1330 -1700	➢ Air conditioning and cooling principles ➢ Laws of thermodynamics ➢ Precision v comfort cooling ➢ Available technologies ➢ DX v central chiller options ➢ Dry cooler ➢ ASHRAE, TIA and CIBSE requirements ➢ Low humidity problems ➢ Ventilation and filtration requirements ➢ New TUI Tier definitions of cooling ➢ Energy saving techniques e.g. dry cooler, air economiser, water economiser ➢ Solar thermal gain ➢ How to calculate heat loads and aircon sizing ➢ kW v tons v BTU of cooling	Class exercise Calculate cooling requirement of a typical computer room and plan N+1 cooling model

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	➢ How much heat comes from IT equipment ➢ Hot aisle/cold aisle options ➢ Enclosed cold and hot aisles ➢ Other rack cooling options ➢ Side to side cooling for large Cisco switches ➢ Water cooled racks ➢ CO_2 cooled racks ➢ Spot cooling ➢ Air flow calculations ➢ TUI Tiering requirements ➢ CFD analysis	
Power Day 2 0900 -1230	➢ BICSI and TIA N, N+1 and 2N power models ➢ EU Code of Conduct requirements ➢ AC v DC ➢ Power, kW and kVA ➢ Power factor issues ➢ Single v 3 phase distribution ➢ Tier 1 -4 models ➢ How to calculate power requirements, UPS and generator sizing ➢ UPS options: Off-line, on line dual conversion, delta, transformerless, ➢ Battery and kinetic energy systems ➢ Emergency Power Off requirements ➢ Power Distribution units	Class Exercise Calculate power requirements of a typical computer, size UPS and generators and plan an N+1 UPS model
IT grade earthing and bonding Day 2 1330 - 1400	➢ European, USA and world standards ➢ EN 50310 and TIA 607 ➢ Grounding bars ➢ Equipotential bonding ➢ Signal reference grids	Exercise 4 *Biochem plc*. Calculate number of racks and power requirements from a list of IT equipment
Cable containment Day 2 1400 -1430	➢ Separation of power and data cables to EU and USA standards ➢ Calculating fill factors ➢ Cable containment options ➢ Affect of different cable sizes ➢ Fire stopping	
Fire Day 2 1430 - 1530	➢ Fire safety plans ➢ Fire detection methods ➢ Aspirating smoke detection (VESDA) ➢ Integrating fire, BMS, HVAC and power systems ➢ Fire suppression techniques ➢ Inert gas v halocarbon techniques ➢ Water mist and low oxygen (hypoxic) methods ➢ Price comparisons	
Low risk fire cabling Day 2 1600 - 1630	➢ American plenum, riser and general purpose cables ➢ European low smoke zero halogen cables ➢ Relative costs	
Introduction to structured cabling Day 2 1630-1700	➢ Evolution of computers, LANs and cabling ➢ International cabling standards ➢ Definitions of Cat 3, Cat5, Cat6, Cat6A and Cat 7	

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Selecting cable components Day 3 0900 -0945	➢ Latest requirements of 10GBASE-T ➢ Defining screened and unscreened (shielded and unshielded) cables ➢ Cable sizes ➢ Copper connectors and patch panels ➢ Optical connectors and components ➢ Preterminated cabling solutions	
Optical cable systems Day 3 0945 - 1030	➢ Matching LANs to cables ➢ Defining optical fibres e.g. OM!, OM3 etc ➢ Latest OM4 and OS2 fibres ➢ Advantages of optical fibre ➢ Value engineering cable and LAN plant	
Cable systems Day 3 1100 - 1200	➢ 2, 3 and 4 connector systems ➢ The ISO 11801 hierarchical model ➢ Intelligent patching options ➢ Tier 1 -4 requirements ➢ Different cabling models e.g. zone cabling, centralised cabling ➢ Best generic designs ➢ US v EU standards and terminology	
Security and BMS Day 3 1200 -1230	➢ Integrating systems with BMS ➢ Facilities management systems ➢ IP v industrial protocols ➢ CCTV methods ➢ Access control ➢ Room, rack or site monitoring ➢ Tier 1 -4 requirements	
Business continuity Day3 1330-1430	➢ Business continuity and disaster recovery ➢ Why data centres fail ➢ Process and operational management	1500 -1700 Final exam

Learning outcomes	Assessment criteria
1. Understand the method of translating an IT requirement e.g. number of racks and servers etc., into a data centre space and size plan	Demonstrate an ability to take a list of customer requirements and a list of IT equipment by planning and sizing the spaces of a data centre example project
2. Understand how to size an air conditioning system in an N or N+1 format	Size an example project when given inputs of IT load, UPS heat, lighting and solar gain
3. Understand how to size a data centre UPS, generator and power supply in an N, N+1 and 2N format	Size an example project when given inputs of IT load, resilience model and customer expansion plans
4. Understand that the basics of successful data centre design require correct location, air conditioning, power and cable interconnection planning	Obtain a mark of at least 60% in the multiple choice test of 40 questions