

## Liverpool John Moores University

Title: ELECTRICAL SERVICES INSTALLATIONS  
Status: Definitive  
Code: **4505BEFDS** (118441)  
Version Start Date: 01-08-2011

Owning School/Faculty: Built Environment  
Teaching School/Faculty: Built Environment

Team	Leader
Derek King	

**Academic Level:** FHEQ4      **Credit Value:** 36.00      **Total Delivered Hours:** 159.00  
**Total Learning Hours:** 360      **Private Study:** 201

### Delivery Options

Course typically offered: Standard Year Long

Component	Contact Hours
Lecture	96.000
Tutorial	36.000
Workshop	24.000

**Grading Basis:** 40 %

### Assessment Details

Category	Short Description	Description	Weighting (%)	Exam Duration
Artefacts	Project		50.0	
Exam	Exam		25.0	3.00
Test	ICA		25.0	3.00

### Aims

*The aim of this module is to develop the students' understanding of the main principles and practices for the design, operation and commissioning of electrical building services systems, lighting and fire detection & security systems in medium sized public sector, commercial or industrial buildings. The module provides students with the knowledge and skills necessary to interpret the needs and requirements of buildings and develop and evaluate a range of practical, efficient*

and sustainable schemes.

## Learning Outcomes

After completing the module the student should be able to:

- 1 Analyse buildings, identify their electrical and lighting needs, and establish design criteria to relevant standards and legislation.
- 2 Assess daylight levels within buildings and utilise appropriate mechanisms for maximising daylight availability and distribution.
- 3 Assess the lighting requirements of complex buildings to select appropriate lighting and emergency lighting equipment.
- 4 Produce and evaluate designs for lighting and emergency lighting schemes for complex buildings.
- 5 Produce and evaluate detailed low and extra low voltage electrical distribution system designs to satisfy the needs of complex buildings.
- 6 Establish the need for circuit protection, lightning protection and surge protection in electrical services installations in buildings and apply this to electrical services design
- 7 Describe the principles and characteristics of fire growth and propagation and smoke dynamics in buildings.
- 8 Apply relevant legislation, standards and strategies for fire safety, fire engineering and security systems to establish requirements for buildings.
- 9 Produce and evaluate detailed designs for fire detection and alarm installations, security detection, monitoring and alarm installations.

## Learning Outcomes of Assessments

The assessment item list is assessed via the learning outcomes listed:

Design project	1	4	5	6	9
Exam	2	3			
In class assessment	7	8			

## Outline Syllabus

*Specification and requirements: analysis of client and building needs, Design criteria and standards: designing for health and safety, risk assessment to identify potential risks. Identification of current design standards, legislative constraints and associated publications.*

*Design of electrical installations: distribution patterns, horizontal, vertical, provision for future development and access. Co-ordination of services. False floor systems, rising mains, sub-main, bus-bar, trunking, conduit, ducting etc. Incorporating resilience, Design of installations incorporating environmental technologies i.e. photo-voltaic, wind turbine installations into electrical installation designs. Accommodation of HV substations: civil requirements, design and plant layout, access, security and safety. Inclusion of current design standards and legislative*

requirements into designs.

*Fundamental requirements for safety: earthing systems and equipment for electrical installations in complex buildings and the inspection & testing of electrical installations to current BS7671 requirements.*

*Applying designers discretion: Assessment of electrical loads, volt-drop, diversity, extending disconnection times, thermal effects, grouping of cables of different c.s.a. and load characteristics, sizing of cables for motor circuits: direct on line, star delta, and inverter control.*

*Circuit protection: The determination of fault-currents and the application of methods for providing circuit over-current and short circuit protection. The selection of fuses, MCB's, and MCCB's for building services installations including variable loads and those consuming heavy currents. Apply BS7671 and/or manufacturer's device operating time-range & characteristics data to protective device selection methods. Apply the principles of Discrimination to the selection of protective device ratings.*

*Data Distribution: Category of circuits, types of distribution topologies, Current standards and protocols for cable and fibre-optic installations, cable types, clean and dirty earth's, earth loops, interference, emission of heat, vibration, earth leakage currents, data/telecommunication, control and SCADA installations, electromagnetic compatibility; conducted, electrostatic, radiated.*

*Lightning and Surge protection: current design standards, determining susceptibility to lightning strike, air termination network, down conductors, earth termination networks, bonding, side-flashing, protection of electrical and data equipment within buildings, cable routes and equipment location.*

*Fundamentals of lighting: terminology and units of light, inverse square law, cosine law, colour temperature*

*Visual effects of lighting: lighting levels, glare, illumination for task performance, appearance, colour rendering, revealing form, display lighting, light modulation*

*Specification and requirements: analysis of client and building requirements, balance between client, commercial, aesthetic and energy efficiency considerations.*

□

*Requirements of specialised lighting situations. Interpretation and application of lighting design standards, publications, legislative constraints and energy targets for complex public sector commercial and industrial buildings. Co-ordination of lighting with other mechanical and electrical services.*

*Daylighting: Features, significance, advantages & disadvantages of daylight in buildings. Components of the daylight factor. Sunlight admission. Impact of different forms, shapes, proportion and location of window and rooflights. Effect of glass type, window bars etc.. Daylight in buildings with atria, advantages and disadvantages.*

*Effect of daylighting on VDU equipment. Use of sun-pipes, fibre optic systems and other techniques for increasing daylight levels and penetration into buildings. No-sky lines, light obstruction and visible sky angles. Day light requirements. Average daylight factors. Manual and Computer calculation/modeling of distribution of daylight in buildings. Climate based daylight modelling.*

*Light sources: natural daylight, lamp types and classifications, identification codes, lamp*

*characteristics, luminous efficacy, lamp life and luminous flux maintenance, lamp control*

*gear LED light sources.*

*Luminaires: standards and markings, luminaire characteristics, luminaires for hostile*

and

*hazardous environments, polar curves and other photometric data, use of illuminance ratio charts, switching and dimming, maintenance. Methods of control (DALI, DSI, DimX512)*

*Design of general lighting systems: for complex and specialised buildings. Layout, specification and control of interior lighting. Exterior lighting, car parks and walkway lighting, integration of lighting with other services installations, integration of artificial lighting with natural day-lighting. LED luminaire technology*

*Design of specialised lighting systems: general for complex buildings requiring specialised lighting solutions. eg laboratories, art galleries, museums, hospitals and operating theatres, retail display, theatre, concert hall and conference lighting etc.*

*Specialised lighting fittings, colour correction and enhancement lighting, integration of artificial lighting with natural lighting etc. Control of lighting levels and lighting systems. Point-to-point illuminance level calculations and computer aided lighting design modeling software*

*Evaluation: evaluation of viability, performance and appropriateness of proposed schemes for meeting building needs.*

*Emergency lighting specification and requirements: identification of current legislation and standards for emergency lighting*

*Design of emergency lighting schemes: escape lighting, standby lighting, lighting levels and locations, speed of operation, maintenance and testing requirements, external escape lighting, test/self test systems.*

*Control of emergency lighting: co-ordination of emergency lighting schemes with other services and emergency systems.*

*Fire dynamics: ignition, fire growth, fire parameters, flash over, limiting fire development, effect of sprinklers, smoke control, smoke hazards, smoke plumes, accumulated smoke layers, smoke filling times, flame calculations.*

*Legislation and standards: fire engineering analysis, Identification and design implications of relevant legislation, standards and codes of practice, role of the client, developing fire safety strategy informed by risk assessments.*

*Fire risk and building designation: building designation factors, risk profiles, fire precaution standards, classification by purpose groups.*

*Means of escape, behaviour of people, occupancy types, travel distances and times. Fire compartments, requirement of compartments, compartmentation in complex buildings.*

*Fire engineering: overview, fire and smoke ventilation, fire fighting and suppression installations, sprinkler systems, hydrant systems, hose-reel and fire fixed and portable extinguisher installations, fire-fighting lifts.*

*Specification of alarm systems: analyse and interpret architectural, client and legislative requirement, conventional and addressable fire detection systems.*

*Fire detection and alarm equipment: manual and automatic systems, fire detection devices, siting and spacing of detectors, alarm sounders, initiation of other safety measures, cables and power supplies, control equipment, hazardous areas.*

*Design and evaluation of fire detection installations:*

*Security Standards and strategies: current standards and codes of practice, concepts of security risk and control strategies, implications for physical deterrents, security detection, surveillance and monitoring systems.*

*Security risk and building designation: risk assessment, building security risk*

*designation factors for standard and specialised threats.*

*Specification of alarm systems: analyse and interpret architectural, client and legislative requirement.*

*Detection and alarm equipment: detection devices, CCTV installations, siting and spacing of detectors, alarm sounders and security recorders, initiation of other security measures, cabling and power supplies, interfacing with BMS systems, telemetry and interconnection. Access control systems. Control room functions and requirements*

*Design of security detection, alarm and monitoring installations: for standard, complex and specialist applications.*

## Learning Activities

Lectures, tutorials, case studies, workshops, site visits.

## References

<b>Course Material</b>	Book
<b>Author</b>	Bayliss, C.R. Hardy B.J.
<b>Publishing Year</b>	2007
<b>Title</b>	Transmission and Distribution in Electrical Engineering
<b>Subtitle</b>	
<b>Edition</b>	3rd
<b>Publisher</b>	Elsevier Ltd.
<b>ISBN</b>	978-0-7506-6673-2

<b>Course Material</b>	Book
<b>Author</b>	Hughes, E. et al
<b>Publishing Year</b>	2008
<b>Title</b>	Hughes Electrical and Electronic Technology
<b>Subtitle</b>	
<b>Edition</b>	10th
<b>Publisher</b>	Pearson Education Ltd.
<b>ISBN</b>	978-0-13-206011-0

<b>Course Material</b>	Book
<b>Author</b>	Cook, P.
<b>Publishing Year</b>	2009
<b>Title</b>	Commentary on IEE Wiring Regulations 17th Edition
<b>Subtitle</b>	BS 767, 2008: Requirements for Electrical Installations
<b>Edition</b>	
<b>Publisher</b>	Institution of Engineering and Technology
<b>ISBN</b>	9781849191456

<b>Course Material</b>	Book
------------------------	------

<b>Author</b>	Tregenza, P.
<b>Publishing Year</b>	2004
<b>Title</b>	The Design of Lighting
<b>Subtitle</b>	Requirements for Electrical Installations - IEE Wiring Regulations
<b>Edition</b>	
<b>Publisher</b>	Spon Press
<b>ISBN</b>	0-419-20440-7

<b>Course Material</b>	Book
<b>Author</b>	Stollard, P. Abrahams, J.
<b>Publishing Year</b>	1995
<b>Title</b>	Fire From First Principles
<b>Subtitle</b>	
<b>Edition</b>	
<b>Publisher</b>	Spon Press
<b>ISBN</b>	0-419-24270-8

<b>Course Material</b>	Book
<b>Author</b>	Honey, G.
<b>Publishing Year</b>	1999
<b>Title</b>	Newnes Electronic Security Systems Pocket Book
<b>Subtitle</b>	
<b>Edition</b>	
<b>Publisher</b>	Butterworth-Heinemann
<b>ISBN</b>	0-7506-3991-1

<b>Course Material</b>	Book
<b>Author</b>	Chartered Institution of Building Services Engineers
<b>Publishing Year</b>	2005
<b>Title</b>	Guide K
<b>Subtitle</b>	Electricity in Buildings
<b>Edition</b>	
<b>Publisher</b>	CIBSE, London
<b>ISBN</b>	190328726X

<b>Course Material</b>	Book
<b>Author</b>	Chartered Institution of Building Services Engineers
<b>Publishing Year</b>	2004
<b>Title</b>	Guide F
<b>Subtitle</b>	Energy Efficiency in Buildings
<b>Edition</b>	
<b>Publisher</b>	CIBSE, London
<b>ISBN</b>	1903287340

<b>Course Material</b>	British Standards
<b>Author</b>	British Standards Institute

<b>Publishing Year</b>	2008
<b>Title</b>	BS7671:2008
<b>Subtitle</b>	
<b>Edition</b>	17th
<b>Publisher</b>	BSI, London
<b>ISBN</b>	0863413700

<b>Course Material</b>	Book
<b>Author</b>	Chartered Institution of Building Services Engineers
<b>Publishing Year</b>	2003
<b>Title</b>	Guide E
<b>Subtitle</b>	Fire Engineering
<b>Edition</b>	
<b>Publisher</b>	CIBSE, London
<b>ISBN</b>	1903287316

---

## Notes

This module is a key component for those students wishing to complete the programme following an 'electrical' building services pathway. It aims to develop an understanding of the principles and processes of electrical, lighting and data installations in commercial and industrial buildings, emphasising the need for energy efficient, sustainable, safe, innovative design strategies whilst recognising the creative nature of lighting design. Furthermore it aims to develop an understanding of the design and specification of modern fire detection and security installations, and integrating these with other building services systems.