Liverpool John Moores University

Title:	BUILDING SERVICES I
Status:	Definitive
Code:	**4504ICBTBS** (126981)
Version Start Date:	01-08-2021
Owning School/Faculty:	Civil Engineering and Built Environment
Teaching School/Faculty:	ICBT, Colombo

Team	Leader
Alison Cotgrave	Y

Academic Level:	FHEQ4	**Credit Value:**	15	**Total Delivered Hours:**	72
Total Learning Hours:	150	**Private Study:**	78		

Delivery Options
Course typically offered: Semester 2

Component	Contact Hours
Lecture	45
Tutorial	15
Workshop	10

Grading Basis: 40 %

Assessment Details

Category	Short Description	Description	Weighting (%)	Exam Duration
Portfolio	AS1	Practical	40	
Exam	AS2	Written Examination(Closed Book)	60	2

Aims

This module introduces the fundamental concepts and principles of refrigeration, HVAC, Electronics and Electricity, lighting system, and the application of these to engineering problems in the built environment.

Learning Outcomes

After completing the module the student should be able to:

1	Demonstrate an understanding of refrigeration effect, different methods of refrigeration, types of refrigerants, and characteristics of refrigerants.
2	Apply basic principles of Air Conditioning and ventilation, heat gain and heat loss calculations for building heating/cooling load estimation, air conditioning systems, air distribution systems and their applications.
3	Apply DC and AC theory, test equipment and circuit design, wiring systems and related safety.
4	Demonstrate an understanding of the lighting system in buildings.

Learning Outcomes of Assessments

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

Practical	1	2	3	4
Written Examination	1	2	3	4

Outline Syllabus

Refrigeration:
Simple Vapour Compression Refrigeration, Evaporating & Condensing temperatures, Maintaining the Constant Mass flow in Evaporator, p-h charts for Refrigerants, Simple Saturated Cycle, Analysis of Vapour Compression Refrigeration Cycle, Effect of Suction Temperature and Condensing Temperature on Cycle Performance, Actual Refrigeration Cycle, Effect of sub-cooling, super heating, Effect of Pressure Losses, Liquid Suction Heat Exchangers.
Properties of Common Refrigerants, Requirement for Refrigerants, Identification of Refrigerants by Coding Number, Classification of Refrigerants, Miscellaneous Properties, Heat Transfer characteristics comparison of the Refrigerants, Refrigerant Selection, Brine Solution.

HVAC System:
Introduction to Ventilation Systems: Basic need for building ventilation, threshold limits of internal contaminants, Natural ventilation and Mechanical ventilation, air flow around buildings.
Methods of Ventilation: Natural, wind effect, stack effect, combined effect; Mechanical, forced, exhaust, combined displacement ventilation methods.
Air Conditioning: Purpose of air conditioning and definitions, types of air-conditioners, system components of HVAC systems.
Psychometric of Air & Air Conditioning Processes: Properties of moist air: Gibbs Dalton law, Specific humidity, Dew Point temperature, Degree of Saturation, Relative Humidity, Enthalpy, Humid Specific Heat, Wet Bulb temp, Thermodynamics Wet Bulb temp; Psychometric Chart, Psychometry of air-conditioning processes, Mixing Process, Basic processes in conditioning of air, Psychometric processes in air washer.
Air Conditioning Load Calculations: Outside and inside design conditions; Sources of

heating load; Sources of cooling load; Heat transfer through structure: Solar radiation, Electrical applications, Infiltration and ventilation, Heat generation inside conditioned space; Difference between Heat Gain and Cooling Load; Apparatus selection; Comfort chart.

Air Conditioning Systems: Unitary systems: Window type, Split type; Package systems; Central systems.
Air Distribution Systems: Single Duct Single Zone, Single Duct Multi Zone Constant Air Volume (CAV), Variable Air Volume (VAV): Terminal box, Parallel fan, Serial fan.
Codes and standards: Codes and standards along with regulations (if available), safety precautionary.

Electronics and Electricity:
Electrons and Electricity: Introduction, Atoms and their structure, electrical charge, Atomic number, Atomic weight, conductors and insulators, electric current, electric voltage, batteries, wet cells, dry cells.
Resistance and Ohm's law: Introduction, Ohm's law, resistors, colour coding of resistors, types of fixed resistors, variable resistors, combination of resistors, series resistances, parallel resistances. 3.
Kirchhoff's Laws: Introduction, Kirchhoff's voltage laws, Loops, Loop current's Sign conventions, Kirchhoff's voltage law in action, Kirchhoff's current law, Nodes, Kirchhoff'f current law in action.
Codes and standards: Codes and standards along with regulations (if available), safety precautionary.

Lighting System:
Introduction to Lighting: Nature and characteristics of light; Aspects of Lighting: importance, applications, key elements; Light Source
Terms & Definitions/Photometric units: Solid Angle, Spectral Power Density, Human Eye Sensitivity Curve, Luminous Flux, Luminous Efficacy, Luminous Intensity and Polar Curves, Illuminance and Inverse Square Law, Luminance, Correlated Color Temperature (CCT), Color Rendering Index (CRI).

Vision & Visual Performance: Structure of the human eye, Operation of the human visual system; of Vision and Visual Performance, Visual Acuity, Contrast Sensitivity, Glare, Reflectance & Exitance, Lighting requirements in Buildings.
Lamps and Luminaires: Lamps (Incandescence, Fluorescence, Solid State): Comparison of characteristics of light sources: Luminous Efficacy, Lumen Output, Lamp Life, CCT, CRI, Factors affecting lamp performance: voltage, temperature, position, time.
Luminaires: Functions of Luminaires, Luminaire Classification, Light Output Ratios, Optical Control Methods, Luminaire Efficiency, System Polar Curves.
Codes and standards: Codes and standards along with regulations (if available), safety precautionary.

Learning Activities

Students will be supported in their learning, to achieve the above learning outcomes, in the following ways:

The module is based on a lecture programme including video and presentations together with a number of practical sessions in workshops.
Students are encouraged to develop competence using scientific equipment in an active learning approach.

Notes

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