Course Description

ESSENTIAL COURSES

BPS5111 Integrated Building Design (Semester 1)

This course aims to provide the concept, principles, methods and practice of integrated building design that adopts total building performance (TBP) as the underlying paradigm. Integration is emphasised, fostering holistic considerations for performance from the structure, facade, mechanical & electrical and interior systems, and consistently devolving this through design development, contracting, construction, commissioning and into the occupancy phases.

BPS5112 Green Building Integration and Evaluation Studio (Semesters 1 & 2)

This is a studio-based course that synthesises the theoretical and practical aspects of building performance and detailed design development, bringing sustainable design concepts and elements to the forefront. The needs for sustainable design and its integration into a holistic performing building will be a key principle of studio learning. Design decision support using simulation tools will be brought to life in studio environment in the realisation of holistic sustainable building. Simulation tools will be used for thermal, ventilation, IAQ, lighting and acoustics. Current sustainable building assessment techniques will be applied. Studio will be jointly conducted by academics and leading industry practitioners; particular focus will be given to sustainable building design covering both new build and retrofit of existing building.

PRESCRIBED ELECTIVES

BPS5221 Microclimate Design (Semester 1)

This course deals with the principles of microclimatic design both at the building and urban level. It emphasises on the elements of microclimates and their effects on building design and the planning of urban settlements and vice-versa. The issues of Urban Heat Island and the possible mitigation measures and their application towards achieving comfort and efficiency with special reference to the humid tropics are emphasised.

BPS5222 Indoor Environmental Quality (Semester 2)

This course deals with the four key performance mandates that are responsible for ensuring good IEQ. The thermal performance deals with thermal comfort in all types of buildings and climates including adaptive comfort models. The indoor air quality (IAQ) performance examines the relationship between IAQ and occupants' well-being and health and identifies the types and sources of indoor air pollutants and means of minimising the problems. The experimental procedures of investigating and analysing thermal and IAQ issues are also introduced. The lighting performance deals with visual perception, colour classifications and lighting installation design with specific reference to integration and control of artificial and day lighting, choice of light sources and lighting systems. The acoustic performance deals with community noise rating systems and the propagation of sound in the urban environment. Environmental noise monitoring and modelling, sound transmission and acoustical design of rooms will be discussed. Laboratory and field measurements using acoustical instruments will be used to strengthen students' understanding and analytical and presentation skills on the subject.

BPS5223 Building Energy Performance - Passive Systems (Semester 1)

This course deals with Energy Efficient (EE) Technologies, i.e. passive systems for Green Buildings. The focus is on building facade optimisation and the EE domain includes thermal, daylight, ventilation performance and the choice of suitable materials as well as the interrelation of these with architectural design (e.g. form, shape, orientation, massing). Analysis and optimisation capability teaching is established on a basic understanding of heat transfer mechanisms in buildings. It also deals with the introduction of prevailing analysis, evaluation and optimisation methodologies.

BPS5224 Building Energy Performance - Active Systems (Semester 1)

This course deals with active design of building systems for good Indoor Environmental Quality (IEQ) and energy performance. It includes the conventional heating, ventilating and air-conditioning (HVAC) systems typical of most existing buildings as well as emerging technologies such as district cooling/heating systems, cogeneration/tri-generation systems and energy efficient air-conditioning and air distribution systems. The Renewable Energy domain includes photo-voltaics, solarthermal, geothermal, wind and fuel cells.

BPS5225 Building Energy Audit and Performance Measurement and Verification (Semester 2)

This course considers the objectives and methodologies in conducting a detailed building energy audit. The course commences with the evaluation of energy performance indicators and their influence on measurement methodology, and the designing of auditing strategy. The statistical interpretation of results, measurement accuracy and instrumentation strategies are also major topics of the course. Once the energy saving opportunities are identified, work shall commence on the evaluation and recommendation of energy conservation measures, and their ranking through the rates of return on investment (ROI). Different modes of procurement in energy retrofit projects and the fundamental principles of Energy Performance Contracting will be examined. Finally, upon the completion of an energy retrofit programme, the requirements and critical conditions for an accurate performance measurement and verification would also be discussed.

BPS5226 Smart Buildings and Facilities (Semester 2)

This course aims to provide the concept and principles of smart buildings and facilities. It discusses the concept of how building performance can be optimised using software and hardware. Students are exposed to building control systems, software, analytics and several case studies are discussed.

BPS5228 Advanced Building Materials and Structures (Semester 2)

This course aims to develop a strong knowledge base on the different building materials and technique of designing structural frames with some of these materials. As a whole, this course focuses on key building materials that are applied to the envelope and structural systems of buildings. For the envelope system, coatings made from advanced nanotechnology and phase change materials will be taught. Conventional yet important structural materials such as wood, steel, wood and masonry will be covered next, leading to the discussion on various types of structural systems and their designs. Finally, life cycle assessment will be introduced as a basis for evaluating and selecting environmentally superior materials.

BPS5230 Data-Driven Decision-Making for Smart Built Environments (Semester 2)

This course provides a broad introduction to data-driven decision-making algorithms and tools for building practitioners and contextualises the applications in smart built environments. One of the main goals is to prepare the students to apply machine learning algorithms to real-world tasks, or to leave them well-qualified to start machine learning or AI research in the built environment. The course will discuss recent applications of data-driven decision-making in the built environment, such as big energy and Indoor Environmental Quality (IEQ) data visualisation, building load forecasting, automated fault detection in HVAC systems, occupant behavior and HVAC system interface, energy customer categorisation, and reinforcement learning based building energy and IEQ management.

BPS5231 AI for Sustainable Building Design (Semester 1)

This course provides a comprehensive introduction to AI and data-driven decision-making for sustainable building projects in the architecture, engineering, and construction (AEC) industry. It emphasises how data analytics, machine learning, and AI technologies can be leveraged to enhance decision-making in various stages of building project design and construction, from concept to completion. The course aims to equip students with practical skills for applying AI tools to real-world challenges, enabling them to work effectively with data or pursue further research in AI for the built environment. Throughout the course, students will explore current applications of AI in the AEC industry, such as tools for optimising building design and building performance simulations, automated design generation, and the integration of generative AI in design workflows. The course will provide hands-on experience with AI and data-driven tools, preparing students to contribute meaningfully to transforming building project design and construction through AI.

BPS5232 Environmental, Social and Governance (ESG) in the Built Environment (Semester 2)

Environmental, Social, and Governance (ESG) factors in the Built Environment are essential drivers of a firm's sustainability. They address disruptions in uncertain times, AI digitalisation, and demographic changes in the transformation of the Built Environment within the Industry 4.0 digital economy in Singapore. This course explains the corporate and business initiatives of both public-listed and non-listed entities ("Firms") in the Built Environment to drive (a) sustainability value, (b) diversity, equity, and inclusion (DEI) goals, and (c) corporate governance, which covers stakeholders' interests in hybrid asset management (i.e., physical and digital assets) in an uncertain business environment. It also covers the ESG implementation process and the management of interconnected risk relationships at the firm level to meet technical and operational (T&O) requirements in both normal and adverse operating conditions in Singapore.

BPS5300 Special Topics in Building Performance and Sustainability (spans 1 semester)

This course aims to develop a strong knowledge base on the different building materials and technique of designing structural frames with some of these materials. As a whole, this course focuses on key building materials that are applied to the envelope and structural systems of buildings. For the envelope system, coatings made from advanced nanotechnology and phase change materials will be taught. Conventional yet important structural materials such as wood, steel, wood and masonry will be covered next, leading to the discussion on various types of structural systems and their designs. Finally, life cycle assessment will be introduced as a basis for evaluating and selecting environmentally superior materials.

BPS5000 Dissertation (spans 2 semesters)

This course is designed to allow students to investigate a topic of their own choice and relevance to the programme and submit a 12,000-word written dissertation. The independent research, under the guidance of a supervisor, is to be conducted over a period of two semesters. This course enables students to develop a deeper understanding in a particular area of the broad domain that may not necessarily be an integral part of the curriculum in the courses offered. The dissertation will be submitted and graded by two examiners.