

MKAE 1013 Advanced Structural analysis (3 credits)

Energy method: Linear and non-linear theory, Theory of Plates and shells: Introduction to shell structures, types of shells and membrane, theory of shells, bending of thin cylindrical shells, application.

MKAE 1143 Finite Element Method (3 credits)

Methods of formulation and development of finite element equation. One-dimensional element, truss and beam element, plane stress element, plane strain, triangular, rectangular and plate bending elements, axis-symmetry and brick elements. Software application, modelling and convergence study and result interpretation.

MKAE 1163 Theory of Plate and Shell (3 credits)

Plasticity theory, governing and constitutive equations in limit state analysis, material properties, yield conditions, theory of plane strain for Coulomb materials. Bending and plane stress problems, yield conditions for slabs, yield line theory, shear, torsion and detailing, bond strength of reinforcing bars.

MKAE 1173 Structural Dynamics (3 credits)

Structural dynamics: Single degree of freedom system, damped and undamped systems, response to harmonic loading. Dynamic loading, response spectra, structural modelling, free and forced vibration, natural frequencies and modes of shape, computer application. Stability analysis: Elastic stability, non-linear response of structures bifurcation, buckling of beams, columns and frames, stability functions, elastic and inelastic behavior of beam-columns at ultimate load, Eigenvalues and Eigenvectors, building codes.

MKAE 1133 Advanced Mechanics of Materials (3 credits)

Continuum mechanics. Displacement and force type of analysis. Principal stress and strain, equation of linear elasticity. Material description laws, plasticity flow rule, fracture mechanics and failure theories. Three-dimensional elasticity, St. Venant torsion and bending theory, Von Mises, Tresca and Mohr-Coulomb principles. Application in torsion, thick cylinder, deep and curved beam.

MKAE 1203 Structural Reliability (3 credits)

Structural safety, risk assessment and reliability engineering concept. The course contents consist of four different module named Systems Reliability, Safety & Risk, Data Analysis & Simulation and Risk Assessment & Safety Management.

MKAE 1073 Advanced Design of Steel Structures (3 credits)

Analysis and design of connections, braced multi-storey frames, semi-continuous and continuous construction. Analysis and design of unbraced multi-storey frames, plate girders and portal frames.

MKAE 1083 Advanced Design of Concrete Structures (3 credits)

Design of support and connections of RC beams, precast, bearing and nibs. Introduction to torsion, membrane and sand analogy. Water retaining structures for cylindrical, rectangular and cone shapes. Analysis and design of continuous slab, waffle slab, flat slab, shear wall.

MKAE 1183 Design of Prestressed Concrete (3 credits)

This is an elective course, which will provide students an understanding and ability to analyse and design of prestressed concrete structural elements. Topics discussed include the concept and principles of prestressing, methods of prestressing concrete, stress limits, losses of prestress, selection

of section, and serviceability and strength requirements. Students will also be exposed to the complete analysis and design procedure of simply supported prestressed concrete non-composite and composite beams, and design principles of continuous beams

MKAE 1193 Design of Precast Concrete (3 credits)

The use of precast concrete multi-storey framed buildings is now widely regarded as an economic, structurally sound and architecturally versatile form of construction. It combines the benefits of very rapid construction and high quality materials with the advantages of production line economy and quality assurance. This subject deals with the design of precast concrete structures. The topics cover the general concepts of precast constructions, analysis and design of slabs, corbels and connections.

MKAJ 1033 Advanced Foundation Engineering (3 credits)

Site Investigation Interpretation for design of foundation. Principles of foundation design, selection of foundation, bearing capacity and settlement problems. Various types of foundation and their criteria for selection will be presented which is interpreted from site investigation related for shallow foundation, pile, raft foundation, drilled shaft, cofferdam, underpinning, Group piles, laterally loaded and uplift piles. Settlement and bearing capacity considerations will be employed to select and design the appropriate foundation scheme for structures. The student will be able to understand and apply the principles of foundation design in terms of technical feasibility, economic viability, articulate and justify technical analyses through oral, written and graphical means.

MKAE 1043 Advanced Construction Materials (3 credits)

This course is designed for students to gain knowledge on advanced construction materials in civil engineering. It will emphasize on advanced concrete, masonry, highway, and geotechnical materials. The topics covered include the use of waste materials and industrial by-products, natural fibres, and polymer in concrete; production of high performance and durable concrete, development of modern masonry in construction, properties and strength of masonry work, design and construction of flexible and rigid pavement, bituminous surfacing, geosynthetic materials. At the end of the course students should be able to describe, identify, and discuss the properties and behaviour of different types of civil engineering materials together with the selection and applications of the materials in practice.

MKAE 1153 Advanced Concrete Technology (3 credits)

Cement hydration, Concrete performance characteristics: permeability and pore structures. Concrete durability: seawater, acid and sulphate attack, alkaline reaction, corrosion of steel reinforcement, cracks in concrete. Medium and high strength concrete, design mix for durable concrete. Quality Control: development of quality assurance specifications and acceptance plans.

MKAE 1033 Structural Assessment and Repair (3 credits)

Introduction to reliability theory, risk-based inspection and analysis. Corrosion mechanism and assessment, partially and non-destructive testing. Strength, durability and integrity assessment, static and dynamic load testing, repair strategy and techniques, repair materials, strengthening techniques, post-repair assessment.

MKAE 1103 Experimental Methods and Analysis (3 credits)

Experimental design, measurement method, experimental strain and stress analysis, yield criterion, fatigue and fracture mechanics, investigation of structural failure, statistical analysis of test data, measurement uncertainty and calibration of equipment, test methods for civil engineering constructions, quality assurance of test and laboratory.

MKAE 1053 Bridge Engineering (3 credits)

Types of bridges, structural system and construction method, bridge loading to BS 5400 and MS standard practices, bridge deck analysis: plate theory, grillages, and finite element. Design of reinforced and pre-stressed concrete, steel and composite bridges.

MKAE 1093 Analysis, Design and Construction of Marine Structures (3 credits)

Types of coastal and offshore structures, response of structures to environmental loading. Materials in marine environment. Analysis and design of port and harbour, offshore steel platforms, marine pipelines and drilling platforms. Inspection, repair and maintenance, corrosion control, structural assessment and removal of disused structures.

MKAE 1023 Analysis and Design of Structural System (3 credits)

Schematic building forms as total structural system, integrity and subsystem interaction, schematic analysis, structural loads and responses, design of horizontal subsystems, design of vertical subsystems, linear components, vertical components, applications to high rise buildings, bridges, suspension and shell systems load bearing structures and foundation subsystems.

MKAE 1063 Tall building System: Analysis and Design (3 credits)

Tall building structural formation and force actions, categories of limit states, methods of analysis. Analysis and design of coupled and core wall structures, vibration of fixed structures, human response to vibration and motions.

MKAE 1113 Structural Wind and Earthquake Engineering (3 credits)

Engineering seismology, seismic response, earthquake resistant design and regulations. Design for dynamic and wind effects, special topics in earthquake engineering.

MKAE 1123 Structural Seismic and Maintenance (3 credits)

This is an optional subject. This subject gives an introduction on seismic maintenance and concepts related to it. Dynamic analysis with computer will also be introduced. Topics related including non-linear seismic analysis, structure and earth interaction, base separation and energy dissipation device.

MKAE 1213 Fire Resistance of Structures (3 credits)

This course emphasizes on the overview of the fundamentals of fire behavior in buildings and introduce simple methods of quantifying the threat it poses to structures. This will involve estimating the temperatures in building compartments and the temperatures that individual structural members get exposed to as a function of time. Fundamentals of the behaviour of common construction materials and estimation of the variation of mechanical properties of construction materials affected by fire. Structural analysis principles are then applied to the fire problem. Simple methods to carry out calculations to determine structural behaviour in the event of a fire will be presented followed by an introduction to advanced analytical and computational tools for analyzing structural behaviour in fire. Finally, introduction to current (code based) design procedures and performance based design and assessment and repair of fire-damaged structures will be provided.