

**POSTGRADUATE PROGRAMMES IN STRUCTURAL ENGINEERING**



**POSTGRADUATE DIPLOMA IN STRUCTURAL  
ENGINEERING**

**Department of Civil Engineering  
Faculty of Engineering  
University of Peradeniya**

## Course Structure

| Course code    | Title   | Compulsory/<br>Optional | Credits  |
|----------------|---|-------------------------|----------|
| CE 6501        | Advanced Concrete Technology                                  | Compulsory              | 3        |
| CE 6502        | Design of Steel Structures                                    | Compulsory              | 3        |
| CE 6503        | Design of Reinforced Concrete Structures                      | Compulsory              | 3        |
| CE 6504        | Finite Element Methods in Structural Mechanics                | Compulsory              | 3        |
| CE 6505        | Structural Dynamics   | Compulsory              | 3        |
| CE 6506        | Wind Engineering  | Optional                | 2        |
| CE 6507        | Earthquake Engineering  | Optional                | 2        |
| CE 6508        | Engineering Materials   | Optional                | 2        |
| CE 6509        | Advanced Foundation Engineering                               | Compulsory              | 3        |
| CE 6510        | Prestressed Concrete Design                                   | Optional                | 2        |
| CE 6511        | Nonlinear Analysis of Frame Structures                        | Optional                | 2        |
| CE 6512        | Forensic Investigation, Repair and Retrofitting of Structures | Optional                | 2        |
| CE 6513        | Numerical Methods for Civil Engineers                         | Optional                | 2        |
| CE 6514        | Design of High-rise Buildings                                 | Optional                | 2        |
| CE 6515        | Bridge Engineering  | Optional                | 2        |
| <b>CE 6102</b> | <b>Independent Study</b>                                      | <b>Compulsory</b>       | <b>3</b> |

Number of credits from compulsory courses: 18

Number of credits from optional courses: 4

Number of credits from independent study: 3

**Total number of credits: 25**

|   |                                       |                   |   |
|---|---------------------------------------|-------------------|---|
| <b>Course Code</b>  | : CE 6501                             |                   |   |
| <b>Course Title</b>   | : <b>Advanced Concrete Technology</b> |                   |   |
| <b>No. of Credits</b>   | : 3                                   |                   |   |
| <b>Pre-requisites</b>   | : None                                |                   |   |
| <b>Compulsory /Optional</b>   | : <b>Compulsory</b>                   |                   |   |
| <b>Aim(s):</b> To teach the properties of concrete and its ingredients so that the students can use this knowledge in specifying, producing, using and caring of concrete for structures.   |                                       |                   |   |
| <b>Intended Learning Outcomes:</b><br>On successful completion of the course, the students should be able to:   |                                       |                   |   |
| <ol style="list-style-type: none"> <li>1. Identify different types of cement based on their composition and performance</li> <li>2. Select most appropriate ingredients, based on their properties, for the production of concrete to suit the application</li> <li>3. Specify concrete with different characteristics for diverse conditions and applications</li> <li>4. Design concrete mixes to achieve specified performance requirements</li> <li>5. Evaluate the properties of concrete, working life, and judge compliance</li> <li>6. Propose suitable procedures for making, delivery, placing, finishing and caring of concrete, giving due consideration for the application</li> <li>7. Assess structural health of concrete structures and plan appropriate rehabilitation methods</li> </ol> |                                       |                   |   |
| <b>Time Allocation (Hours)</b>  | Lectures: 40                          | Tutorials: 03     | Practicals: Assignments: 04<br>Independent learning: 103 (Notional hours=150) |
| <b>Course Content/Course Description:</b>   |                                       |                   |   |
| <b>Cement production</b><br>Constituents; method of production; chemical reactions  |                                       |                   |   |
| <b>Types of cement:</b> Cement types; classification  |                                       |                   |   |
| <b>Chemical and mineral admixtures:</b> Characteristics; applications   |                                       |                   |   |
| <b>Aggregate:</b> Types; classifications; testing   |                                       |                   |   |
| <b>Proportioning of concrete mixes:</b> Mix design methods; self-compacting concrete design; zero-slump concrete design   |                                       |                   |   |
| <b>Concept of high-performance concrete:</b> Materials; attributes; mix design  |                                       |                   |   |
| <b>Properties of fresh and hardened concrete</b><br>Fresh/hardened concrete properties; concrete testing  |                                       |                   |   |
| <b>Compliance criteria, Production of concrete</b><br>Mixing; transporting; compaction; curing  |                                       |                   |   |
| <b>Temperature effects in concrete</b><br>Temperature development; adiabatic temperature; temperature prediction; temperature control   |                                       |                   |   |
| <b>Durability of concrete and maintenance:</b> Carbonation; sulphate attack, ASR/ ACR reactions   |                                       |                   |   |
| <b>Assessment of working life :</b> Carbonation assessment; half-cell potential assessment  |                                       |                   |   |
| <b>Special types of concrete and their applications :</b> Roller compacted concrete; fibre reinforced concrete; shotcrete   |                                       |                   |   |
| <b>Testing of concrete in structures;</b> Non-destructive and semi-destructive testing  |                                       |                   |   |
| <b>Evaluation of concrete in structures, Planning and design of concrete repair , Materials and methods for repair and rehabilitation</b>   |                                       |                   |   |
| <b>Recommended Texts</b><br>Neville, A.M., (2012). Properties of Concrete, 5 <sup>th</sup> edition, Pearson.<br>Woodson, R.D., (2009). Concrete Structures, Elsevier, Oxford  |                                       |                   |   |
|   |                                       | <b>Assessment</b> | <b>Percentage Marks</b>   |
| In-Course   | Assignments/Course work               |                   | 10  |
|   | Mid Semester Examination              |                   | 30  |
| End of Semester Examination   |                                       |                   | 60  |

|  |   |                         |
|--|---|-------------------------|
| <b>Course Code</b>   | : CE 6502   |                         |
| <b>Course Title</b>  | : Design of Steel Structures  |                         |
| <b>No. of Credits</b>  | : 3   |                         |
| <b>Pre-requisites</b>  | : None  |                         |
| <b>Compulsory/Optional</b>   | : Compulsory  |                         |
| <b>Aim(s):</b> The objective of this course is to develop a sound knowledge on the design of steel structures.   |   |                         |
| <b>Intended Learning Outcomes:</b><br>At the end of this course, students should be able to,   |   |                         |
| <ol style="list-style-type: none"> <li>1. Explain the holistic behaviour of steel structures</li> <li>2. Design of elements subjected to axial, shear, bending and combined effects</li> <li>3. Design elements using plastic theory</li> </ol>  |   |                         |
| <b>Time Allocation (Hours)</b>   | Lectures: 40 Tutorials: 03 Practical: - Assignments: 04<br>Independent learning: 103 (Notional hours = 150) |                         |
| <b>Course Content/Course Description:</b>  |   |                         |
| <b>Introduction:</b><br>Introduction to design of steel structures, materials behaviour, properties of structural steel, steel grades, steel sections.   |   |                         |
| <b>Limit state design and code of practice:</b><br>Simple and continuous structures, limit state design, code of practice, cross section classification, section properties, holistic behaviour of structures.   |   |                         |
| <b>Design of structural members:</b><br>Design of tension members, compression members, restrained and unrestrained beams, stocky and slender columns, special types of struts, columns in simple structures, columns under combined axial loads and moments.  |   |                         |
| <b>Design of connections:</b><br>Connections in simple and continuous structures, design of bolted and welded connections, design of column bases.   |   |                         |
| <b>Design of portal frames:</b><br>Plastic analysis, frame stability, local buckling, lateral distortion, torsional restraints, design of haunches.  |   |                         |
| <b>Design of plate girders:</b><br>Sizing plate girders, section classification, moment and shear capacities, design of end panels and intermediate stiffeners.  |   |                         |
| <b>Steel - concrete composites:</b> Design of steel - concrete composite members.  |   |                         |
| <b>Recommended Texts</b><br>EN 1993-1-1:2005, Design of Steel Structures – Part 1.1 General Rules and Rules for Buildings.<br>Brettle, M. E., Brown, D. G., 2009, “ <u>Steel Building Design: Concise Eurocodes</u> ”, SCI Publication, Berkshire.<br>Trahair, N. S., et al., 2008, “ <u>The Behaviour and Design of Steel Structures to EC3</u> ”, 4th Edition, Taylor & Francis, Oxon.<br>Way, A. G. J., Salter, P. R., 2003, “ <u>Introduction to Steelwork Design to BS 5950:2000</u> ”, SCI Publication, Berkshire. |   |                         |
|  | <b>Assessment</b>   | <b>Percentage Marks</b> |
| In-Course  | Assignments/ Course work (take home)  | 50                      |
|  | Mid Semester Examination  | -                       |
| End of Semester Examination  |   | 50                      |

|   |   |                         |
|---|---|-------------------------|
| <b>Course Code</b>  | : CE 6503   |                         |
| <b>Course Title</b>   | : Design of Reinforced Concrete Structures  |                         |
| <b>No. of Credits</b>   | : 3   |                         |
| <b>Pre-requisites</b>   | : None  |                         |
| <b>Compulsory/Optional</b>  | : Compulsory  |                         |
| <b>Aim(s):</b> To provide Engineers with a thorough understanding of the design of reinforced concrete structures.  |   |                         |
| <b>Intended Learning Outcomes:</b><br>At the end of this course, students should be able to;  |   |                         |
| <ol style="list-style-type: none"> <li>1. Generalise the guiding principles of the serviceability limit state and the ultimate limit state concepts and how they relate to the design of structures.</li> <li>2. Summaries the fundamental mechanics of reinforced concrete and the empirical assumptions made for analysis</li> <li>3. Apply fundamental mechanics to the design of reinforced concrete beams and slabs at the serviceability limit state including determination of short and long term deflection and crack widths.</li> <li>4. Apply fundamental mechanics to the design of reinforced concrete beams and slabs at the ultimate limit state including determination of member strength (flexural and shear) and ductility.</li> <li>5. Apply fundamental mechanics to the design of reinforced concrete columns at the ultimate limit state including determination strength under uniaxial and biaxial bending.</li> <li>6. Apply fundamental mechanics to the design of pile caps and water retaining structures</li> </ol> |   |                         |
| <b>Time Allocation (Hours)</b>  | Lectures:42    Assignments:06    Independent learning:102<br>(Notional hours=150) |                         |
| <b>Course Content/Course Description:</b>   |   |                         |
| <p><b>Introduction:</b> Objectives and methods of analysis and design, Properties of concrete and reinforcing steel, Design concepts</p> <p><b>Limit State Design:</b> Limit state of collapse, Limit state of serviceability</p> <p><b>Design of RC beams:</b><br/>Flexure -Singly/doubly RC beams, Flanged beams<br/>Shear design<br/>Bond, anchorage, development length and torsion<br/>Serviceability limit state check<br/>Curtailement<br/>Deep beam design</p> <p><b>Compression Members:</b> RC Short column, RC Slender column</p> <p><b>Reinforced Concrete Slabs:</b> One way slab, Two way slab, Yield line theory, Serviceability limit state check, Pile cap design</p> <p><b>Design of Water Retaining Structures</b></p>   |   |                         |
| <b>Recommended Texts</b>  |   |                         |
| Nilson, A. H., D. Darwin, and C. W. Dolan. Design of Concrete Structures. 13th ed. McGraw-Hill, 2004.   |   |                         |
| <b>Assessment</b>   |   | <b>Percentage Marks</b> |
| In-Course   | Assignments/Course work   | 40                      |
| End of Semester Examination   |   | 60                      |

|   |  |                       |                         |
|---|--|-----------------------|-------------------------|
| <b>Course Code</b>  | : CE 6504  |                       |                         |
| <b>Course Title</b>   | : Finite Element Methods in Structural Mechanics |                       |                         |
| <b>No. of Credits</b>   | : 3  |                       |                         |
| <b>Pre-requisites</b>   | : None   |                       |                         |
| <b>Compulsory/Optional</b>  | : Compulsory                                     |                       |                         |
| <b>Aim(s):</b> To reinforce the knowledge on displacement based finite element method used in analysing civil engineering problems.   |  |                       |                         |
| <b>Intended Learning Outcomes:</b>  |  |                       |                         |
| At the end of this course, students should be able to;  |  |                       |                         |
| <ol style="list-style-type: none"> <li>1. Explain the displacement based finite element methods and their limitations for analysis of civil engineering problems.</li> <li>2. Apply the finite element method with specific emphasis on its applications to planer elastic problems and three dimensional problems.</li> <li>3. Analyse 2D and 3D engineering problems by using commercially available Finite Element (FE) software.</li> </ol> |  |                       |                         |
| <b>Time Allocation (Hours)</b>  | Lectures: 40                                     | Tutorials: Practical: | Assignments: 10         |
|   | Independent learning: 100 (Notional hours=150)   |                       |                         |
| <b>Course Content/Course Description:</b>   |  |                       |                         |
| <b>Introduction to finite element method.</b>   |  |                       |                         |
| <b>Review of displacement based finite element method - 1D element.</b>   |  |                       |                         |
| <b>2-Dimensional plane stress/strain element formulation:</b>   |  |                       |                         |
| Problem differential equation, constant strain triangular (CST) element formulation, 4-node quadrilateral element formulation using isoparametric formulation, Numerical integration; Gauss Quadrature, Gauss point, Higher order elements, shear locking.  |  |                       |                         |
| <b>Plate bending element formulation:</b>   |  |                       |                         |
| Derivation of problem differential equation, 4-node rectangular element formulation (one of the earliest plate bending formulation), 4-node quadrilateral plate bending element formulation using Mindlin and Reissner plate theory.  |  |                       |                         |
| <b>Shell element formulation:</b>   |  |                       |                         |
| <b>Solid element formulation:</b>   |  |                       |                         |
| 8-node solid element formulation using isoparametric formulation, Higher order elements   |  |                       |                         |
| <b>Use of general purpose finite element programs:</b> Pre-processor, mesh generation, renumbering for efficiency, post-processors, use of finite element methods in CAD/CAE, applications of general purpose finite element programs.  |  |                       |                         |
| <b>Recommended Texts</b>  |  |                       |                         |
| Logan, D 2007, <i>First Course in Finite Element Method</i> , 4 <sup>th</sup> edn, Nelson Engineering.  |  |                       |                         |
| Desai, C 2005, <i>Introduction to the Finite Element Method</i> , 1 <sup>st</sup> edn, CBS Publisher.   |  |                       |                         |
| Weaver, W and Gere, JM 2004, <i>Matrix Analysis of Framed Structures</i> , 2 <sup>nd</sup> edn, Springer.   |  |                       |                         |
| <b>Assessment</b>   |  |                       | <b>Percentage Marks</b> |
| In-Course   | Assignments/ Course work                         |                       | 20                      |
|   | Mid Semester Examination                         |                       | 20                      |
| End of Semester Examinations  |  |                       | 60                      |

|   |                          |                   |  |
|---|--------------------------|-------------------|--|
| <b>Course Code</b>  | : CE 6505                |                   |  |
| <b>Course Title</b>   | : Structural Dynamics    |                   |  |
| <b>No. of Credits</b>   | : 3                      |                   |  |
| <b>Pre-requisites</b>   | : None                   |                   |  |
| <b>Compulsory/Optional</b>  | : Compulsory             |                   |  |
| <b>Aim(s):</b> To impart fundamental knowledge on dynamic behaviour of structures.  |                          |                   |  |
| <b>Intended Learning Outcomes:</b><br>At the end of this course, students should be able to,  |                          |                   |  |
| <ol style="list-style-type: none"> <li>1. Describe the effect of dynamic loading on structures.</li> <li>2. Analyse the responses of single/ multi degree of freedom and continuous structures under various dynamic loading.</li> <li>3. Analyse and design of vibration suppression systems.</li> </ol> |                          |                   |  |
| <b>Time Allocation (Hours)</b>  | Lectures: 38             | Tutorials: 14     | Practicals: 14<br>Assignments: 14<br>Independent learning: 98 (Notional hours = 150) |
| <b>Course Content/Course Description:</b>   |                          |                   |  |
| <b>Dynamics of Simple Structures (Single-Degree-of-Freedom systems)</b><br>Equation of motion, Free vibrations, Response to harmonic force, Response to periodic force, Response to arbitrary dynamic force.  |                          |                   |  |
| <b>Multi-Degree-of-Freedom Structures</b><br>Formulation of matrix equations of motion, Analysis of free vibrations, Modal analysis and forced vibrations, Steady state response.   |                          |                   |  |
| <b>Continuous Structures</b><br>Partial differential equations of motions (for strings, bars, beams), Modal analysis.   |                          |                   |  |
| <b>Random Vibrations</b><br>Probability theory, random processes, Correlation and spectral density functions, Response to stationary random excitations, Crossing, peak distributions, extreme value analysis, evaluation of fatigue life, Application to wind engineering.                               |                          |                   |  |
| <b>Control of Dynamic Response</b><br>Overview of vibration control, Tuned Mass Dampers, Active control.  |                          |                   |  |
| <b>Applications of Structural Dynamics</b><br>Model validations, Vibration based structural health monitoring.  |                          |                   |  |
| <b>Recommended Texts</b><br>R. W. Clough, and J. Penzien, (1993), <i>Dynamics of Structures</i> , McGraw-Hill, New York, 2nd Edition.<br>A. K. Chopra, (1995), <i>Dynamics of Structures-Theory and Applications to Earthquake Engineering</i> , Prentice Hall, New Jersey.                               |                          |                   |  |
|   |                          | <b>Assessment</b> | <b>Percentage Marks</b>  |
| In-Course   | Assignments/ Course work |                   | 40   |
| End of Semester Examinations  |                          |                   | 60   |

|  |                           |                   |  |
|--|---------------------------|-------------------|--|
| <b>Course Code</b>   | : CE 6506                 |                   |  |
| <b>Course Title</b>  | : Wind Engineering        |                   |  |
| <b>No. of Credits</b>  | : 2                       |                   |  |
| <b>Pre-requisites</b>  | : None                    |                   |  |
| <b>Compulsory/Optional</b>   | : Optional                |                   |  |
| <b>Aim(s):</b> To impart knowledge on fundamentals and the operative techniques of wind engineering with special regard for wind actions and effects on structures.  |                           |                   |  |
| <b>Intended Learning Outcomes:</b><br>At the end of this course, students should be able to,<br><ol style="list-style-type: none"> <li>1. Explain wind characteristics, wind loading and bluff-body aerodynamics.</li> <li>2. Evaluate aeroelastic phenomena of structural system.</li> <li>3. Design structures for wind loadings.</li> </ol>   |                           |                   |  |
| <b>Time Allocation (Hours)</b>   | Lectures: 27              | Tutorials: 03     | Practical: Assignments:<br>Independent learning: 70 (Notional hours = 100) |
| <b>Course Content/Course Description:</b>  |                           |                   |  |
| <b>Introduction to Wind Engineering:</b><br>The nature of wind from meteorological viewpoints, Wind induced damage   |                           |                   |  |
| <b>Wind Characteristics:</b><br>Description of wind characteristics from engineering viewpoints  |                           |                   |  |
| <b>Wind Loading and Bluff-Body Aerodynamics:</b><br>Introduction to bluff-body aerodynamics, Aerodynamic drag ( $C_D$ ), lift ( $C_L$ ), moment ( $C_M$ ) and pressure ( $C_P$ ), Effects of viscosity and Reynold number ( $Re$ ) to flow pattern around bluff-body, Factors affect the aerodynamics coefficients ( $C_D$ , $C_L$ , $C_M$ and $C_P$ ), Periodic vortex induced forces, Random wind forces caused by random wind velocity fluctuations |                           |                   |  |
| <b>Aeroelastic Phenomena:</b><br>Classification of wind effects on structure, Static wind load effects, Vortex induced oscillation, Galloping induced oscillation, Flutter induced oscillation   |                           |                   |  |
| <b>Wind Resistant Design:</b><br>Tall buildings, Long-span bridges, Wind tunnel tests, Aerodynamic and mechanical approaches to suppress wind-induced responses  |                           |                   |  |
| <b>Recommended Texts</b><br>Holmes, D. J. 2007, <i>Wind Loading of Structures</i> , 2 <sup>nd</sup> edn, Taylor & Francis.<br>Clough, R. and Penzien, J. 1975, <i>Dynamics of Structures</i> , 4 <sup>th</sup> edn, McGraw-Hill.<br>Chopra, A. K. 2011, <i>Dynamics of Structures</i> , 4 <sup>th</sup> edn, Prentice Hall.  |                           |                   |  |
|  |                           | <b>Assessment</b> | <b>Percentage Marks</b>  |
| In-Course  | Assignments:              |                   | 20   |
|  | Mid Semester Examination: |                   | 30   |
| End of Semester Examinations   |                           |                   | 50   |



|  |   |                         |
|--|---|-------------------------|
| <b>Course Code</b>   | : CE 6507   |                         |
| <b>Course Title</b>  | : Earthquake Engineering  |                         |
| <b>No. of Credits</b>  | : 2   |                         |
| <b>Pre-requisites</b>  | : None  |                         |
| <b>Compulsory/Optional</b>   | : Optional  |                         |
| <b>Aim(s):</b> To impart knowledge on Earthquake Engineering aspects.  |   |                         |
| <b>Intended Learning Outcomes:</b><br>At the end of this course, students should be able to,   |   |                         |
| <ol style="list-style-type: none"> <li>1. Explain the fundamental concepts, principles and application of earthquake engineering in seismic analysis.</li> <li>2. Analysis of structures for earthquake loadings.</li> <li>3. Design of structures for earthquake loadings.</li> </ol>   |   |                         |
| <b>Time Allocation (Hours)</b>   | Lectures: 28    Assignments: 04    Independent learning: 68<br>(Notional hours = 100) |                         |
| <b>Course Content/Course Description:</b>  |   |                         |
| <p><b>Nature of Earthquakes;</b> Sources of earthquake ground motions, measures of earthquake intensity and damage potential, seismicity in and around Sri Lanka, effects of earthquakes on structures: lesson learned from past earthquakes.</p> <p><b>Response of Simple Structures to Earthquake Ground Motions;</b> equation of motion for base excitation, solution of the SDOF system, earthquake response spectra.</p> <p><b>Seismic Analysis Procedures (Force-based procedure);</b> linear elastic design spectrum and inelastic design spectrum, analysis procedures for building structures, basic design principles and performance requirements.</p> <p><b>Seismic Design Principles for RC Structures;</b> structural systems/ types of buildings, capacity design principles, ductility in reinforced concrete, capacity design procedure.</p> <p><b>Force-Based vs. Direct Displacement-Based Design</b></p> <p><b>Damage Avoidance Design;</b> base isolation, rocking precast structural systems</p> |   |                         |
| <b>Recommended Texts</b>   |   |                         |
| Priestley, M.J.N., Calvi, G.M. and Kowalsky, M.J. (2007). Direct displacement based design of structures, IUSS Press, Pavia, Italy   |   |                         |
| Chopra, A. K. (2017), "Dynamics of structures: theory and application to earthquake engineering", 5 <sup>th</sup> Edition, Prentice Hall International, Inc. Englewood Cliff   |   |                         |
| <b>Assessment</b>  |   | <b>Percentage Marks</b> |
| In-Course  | Assignments/Course work   | 40                      |
| End of Semester Examinations   |   | 60                      |

|  |  |   |
|--|--|---|
| <b>Course Code</b>   | : CE 6508  |   |
| <b>Course Title</b>  | : Engineering Materials  |   |
| <b>No. of Credits</b>  | : 2  |   |
| <b>Pre-requisites</b>  | : None   |   |
| <b>Compulsory/ Optional</b>  | : Optional   |   |
| <b>Aim(s):</b> The objective of this course is to provide a sound knowledge in structure and properties of engineering materials, advanced materials, material selection and design  |  |   |
| <b>Intended Learning Outcomes:</b><br>At the end of this course, students should be able to;   |  |   |
| <ol style="list-style-type: none"> <li>1. Identify different classes of materials based on structure - property and process relationships</li> <li>2. Select appropriate materials for intended purposes</li> <li>3. Carryout lifelong learning on new materials and their applications</li> </ol> |  |   |
| <b>Time Allocation (Hours)</b>   | Lectures: 26    Tutorials: 03    Practical:    Assignments: 02 | Independent learning: 69 (Notional hours=100) |
| <b>Course Content/Course Description:</b>  |  |   |
| <b>Introduction:</b><br>Introduction to materials, material classes and properties, price and availability of materials, material efficient designs.   |  |   |
| <b>Polymers:</b><br>Generic polymers, GFRP, CFRP and KFRP, mechanical behaviour of polymers, polymer composites, advance engineering applications of polymers and polymer composites.  |  |   |
| <b>Ceramics and glasses:</b> Classes of ceramics and glasses, cement and concrete, rocks and minerals, mechanical properties, high performance ceramics, ceramic composites, ceramic matrix composites (CMC), advanced engineering applications of ceramics, glasses and composites.               |  |   |
| <b>Metals:</b> Ferrous and non-ferrous metals, alloys, light alloys, mechanical properties of metals and alloys, metal matrix composites (MMC), selection of metals and alloys for designs.  |  |   |
| <b>Materials and energy:</b> Energy economy, material contents in products, alternative materials, production process.   |  |   |
| <b>Advanced Materials:</b> Carbon-carbon composites, cellular solids and foams, micro-composites, Nano-materials.  |  |   |
| <b>Construction Materials:</b> Sustainability of construction materials Local and regional materials, Alternative materials for construction.  |  |   |
| <b>Recommended Texts</b>   |  |   |
| Ashby, M. F., and Jones, D. R. H., (1996). " <u>Engineering Materials I</u> ", 2nd Edition, Butterworth - Heinemann (or any edition from the 2nd edition).   |  |   |
| Ashby, M. F., and Jones, D. R. H., (1998). " <u>Engineering Materials II</u> ", 2nd Edition, Butterworth - Heinemann (or any edition from the 2nd edition).  |  |   |
| Ashby, M. F., (2005). " <u>Materials Selection in Mechanical Design</u> ", 3rd Edition, Elsevier (or any edition from the 3rd edition).  |  |   |
|  | <b>Assessment</b>  | <b>Percentage Marks</b>                       |
| In-Course  | Assignments/ Course work (take home)                           | 40  |
| End of Semester Examinations   |  | 60  |

|   |  |
|---|--|
| <b>Course Code</b>  | : CE 6509  |
| <b>Course Title</b>   | : <b>Advanced Foundation Engineering</b>   |
| <b>No. of Credits</b>   | : 3  |
| <b>Pre-requisites</b>   | : None   |
| <b>Compulsory/Optional</b>  | : <b>Compulsory</b>  |
| <b>Aim(s):</b> To impart knowledge and understanding of fundamental concepts of bearing capacity theory, to analyse and design different types of shallow foundations subjected to static and dynamic loads and deep foundations subjected to axial/lateral loads and uplift using Eurocode 7.  |  |
| <b>Intended Learning Outcomes:</b><br>On successful completion of the course, the student should be able to,<br><ol style="list-style-type: none"> <li>1. Analyse and design different types of shallow foundations including spread, strap, combined and raft foundations subjected to static and dynamic loads.</li> <li>2. Analyse and design axially loaded single and group piles and caisson foundations in granular and cohesive soils.</li> <li>3. Analyse and design laterally loaded piles and piles subjected to uplift.</li> <li>4. Carry out a comprehensive design of foundations of a proposed building considering the soil stratigraphy at the site and loading conditions</li> </ol>  |  |
| <b>Time Allocation (Hours)</b>  | Lectures: 40    Tutorials:    Assignments: 20<br>Independent learning: 90 (Notional hours=150) |
| <b>Course Content/Course Description:</b><br><b>Shallow foundations:</b><br>Bearing capacity theories, Shallow foundation design using Eurocode 7, eccentric and inclined loads, bearing capacity on slopes, Bearing capacity of layered soils, foundation settlements<br><b>Design of combined and raft foundations:</b><br>flexible and rigid design of combined footings and raft foundations<br><b>Machine foundations:</b><br>Types of machines, design criteria, elements of vibration theory, governing equations<br><b>Deep foundations:</b><br>Introduction, bearing capacity of group piles, Quality Control and Quality assurance of pile foundation, Design of deep foundations using Eurocode 7, Negative skin friction, Pile group settlement, Rock socketed piles, Laterally loaded piles, Piles subjected to uplift, Design of Caissons in sand and clay<br><b>Design Exercise:</b><br>Design of foundation of a building |  |
| <b>Recommended Texts</b><br>Das B.M., (2011). "Principles of Foundation Engineering", 7 <sup>th</sup> edition, PWS Publishers.<br>Coduto D.P., (2001). "Foundation design principles and practices", 2 <sup>nd</sup> edition, Prentice Hall.<br>Smith I., (2014). "Smith's Element of Soil Mechanics (Design to Eurocode)", 9 <sup>th</sup> edition, Blackwell publishing.<br>Tomlinson M., Woodward J., (2007). "Pile design and construction practice", 5 <sup>th</sup> edition, Taylor and Francis.<br>Frank R., (2004). "Designers' guide to EN 1997-1 Eurocode 7: Geotechnical design-General rules", Thomas Telford.<br>Orr T.L.L., Eric R.F.,(2012). "Geotechnical design to Eurocode 7", Springer Science & Business Media.<br>PLAXIS 2D, (2015). "Scientific Manual".<br>STN E., (2004). "Eurocode 7: "Geotechnical design. Part 1: General rules, BS EN 1997-1: 2004", Bratislava: Slovak Standards Institute, Slovak Republic. |  |

| <b>Assessment</b>            |                          | <b>Percentage Marks</b> |
|------------------------------|--------------------------|-------------------------|
| In-Course                    | Assignments/Course work  | 20                      |
|                              | Mid Semester Examination | 30                      |
| End of Semester Examinations |                          | 50                      |

|  |                               |                   |  |
|--|-------------------------------|-------------------|--|
| <b>Course Code</b>   | : CE 6510                     |                   |  |
| <b>Course Title</b>  | : Prestressed Concrete Design |                   |  |
| <b>No. of Credits</b>  | : 2                           |                   |  |
| <b>Pre-requisites</b>  | : None                        |                   |  |
| <b>Compulsory/Optional</b>   | : Optional                    |                   |  |
| <b>Aim(s):</b> To impart knowledge on prestressed concrete (PC) design concepts so that the students can use this knowledge when they design/construct PC structures.  |                               |                   |  |
| <b>Intended Learning Outcomes:</b><br>At the end of this course, students should be able to,   |                               |                   |  |
| <ol style="list-style-type: none"> <li>1. Describe prestressed concrete design concepts.</li> <li>2. Design simply supported prestressed concrete beams, composite and continuous prestressed concrete beams and prestressed concrete slabs.</li> <li>3. Produce design information in the form of detailed drawings and specifications.</li> </ol>  |                               |                   |  |
| <b>Time Allocation (Hours)</b>   | Lectures: 29                  | Tutorials: 02     | Practicals: 02<br>Assignments: 02<br>Independent learning: 69 (Notional hours = 100) |
| <b>Course Content/Course Description:</b>  |                               |                   |  |
| <b>History of prestressed concrete</b><br>Use of prestress in non-concrete structures; application on concrete structures; characteristics; attributes   |                               |                   |  |
| <b>Prestressing systems</b><br>Pre-tensioning systems; post-tensioning systems; anchoring systems  |                               |                   |  |
| <b>Principles of prestressed concrete design</b><br>Stress calculation; stress limits  |                               |                   |  |
| <b>SLS and ULS design</b><br>Magnet diagram; tendon profile; deflection; ULS   |                               |                   |  |
| <b>Composite section design</b>  |                               |                   |  |
| <b>Prestress loss assessment</b><br>Short-term losses; long-term losses  |                               |                   |  |
| <b>Continuous beam design</b><br>Parasitic forces; concordant profile  |                               |                   |  |
| <b>Prestressed concrete slab design</b>  |                               |                   |  |
| <b>New materials</b> Fibre reinforced polymer  |                               |                   |  |
| <b>Recommended Texts</b><br>EN 1992-1-1:2004, Design of Concrete Structures – Part 1-1: General rules and rules for buildings<br>EN 1992-2:2005, Design of Concrete Structures – Part 2: Concrete Bridges – Design and Detailing Rules<br>Hurst, M.K., 1998, <i>Prestressed Concrete Design</i> , 2 <sup>nd</sup> Edition, Taylor and Francis, Oxon<br>Lin, T.Y. and Burns, N.H., 1982, <i>Design of Prestressed Concrete Structures</i> – 3 <sup>rd</sup> Edition, John Wiley & Sons<br>Mosley, B., Bungey, J. and Hulse, R., 2007, <i>Reinforced Concrete Design to Eurocode 2</i> , 7 <sup>th</sup> Edition, Palgrave Macmillan |                               |                   |  |
|  |                               | <b>Assessment</b> | <b>Percentage Marks</b>  |
| In-Course  | Assignments/ Course work      |                   | 20   |
|  | Mid Semester Examination      |                   | 30   |
| End of Semester Examinations   |                               |                   | 50   |

|  |   |                   |   |
|--|---|-------------------|---|
| <b>Course Code</b>   | : CE 6511                                       |                   |   |
| <b>Course Title</b>  | : <b>Nonlinear Analysis of Frame Structures</b> |                   |   |
| <b>No. of Credits</b>  | : 2   |                   |   |
| <b>Pre-requisites</b>  | : None  |                   |   |
| <b>Compulsory/Optional</b>   | : <b>Optional</b>                               |                   |   |
| <b>Aim(s):</b> To reinforce the knowledge on analysis of frame structures for nonlinear response incorporating the material and geometric nonlinearity.  |   |                   |   |
| <b>Intended Learning Outcomes:</b>   |   |                   |   |
| At the end of this course, students should be able to,   |   |                   |   |
| <ol style="list-style-type: none"> <li>1. Explain the different approaches for modelling of frame structures for nonlinear analysis.</li> <li>2. Explain different incremental iterative solution methods.</li> <li>3. Analyse frame structures for static and dynamic loadings.</li> <li>4. Evaluate the difference between displacement-based and force-based frame elements.</li> </ol> |   |                   |   |
| <b>Time Allocation (Hours)</b>   | Lectures: 25                                    | Tutorials: 10     | Practical: 10<br>Assignments: 10<br>Independent learning: 65 (Notional hours = 100) |
| <b>Course Content/Course Description:</b>  |   |                   |   |
| <b>Introduction to nonlinear frame analysis:</b>   |   |                   |   |
| Failure modes observed in reinforced concrete and steel frame structures; plastic hinge development due to moment-axial interaction, shear failure of short element, large displacement induced by torsional response.   |   |                   |   |
| <b>Nonlinear frame models:</b>   |   |                   |   |
| Frame element with lumped plasticity; plastic hinge,   |   |                   |   |
| Frame element with distributed plasticity; Displacement based formulation, force based formulation,  |   |                   |   |
| Numerical integration; Gauss Quadrature and Gauss Lobatto, Section models,   |   |                   |   |
| Uni-axial material constitutive models for nonlinear hysteretic response   |   |                   |   |
| <b>Incremental-Iterative solution strategies:</b>  |   |                   |   |
| Load control method,   |   |                   |   |
| Displacement control method; Newton Raphson, Modified Newton Raphson, Krylow Newton Raphson, Arc length method;  |   |                   |   |
| Convergence criteria.  |   |                   |   |
| <b>Analysis of nonlinear geometry:</b>   |   |                   |   |
| Co-rotational formulation.   |   |                   |   |
| <b>Recommended Texts</b>   |   |                   |   |
| Nonlinear Finite Element Analysis of Solids and Structures, M. A. Crisfield, Wiley and Sons, 1991  |   |                   |   |
| Computational Inelasticity, J.C. Simo and T. J.R Hughes, Springer-Verlag, 1998.  |   |                   |   |
| Practical Programming in Tcl and Tk, B.B. Welch, Prentice-Hall, 2000   |   |                   |   |
| OpenSees Manual  |   |                   |   |
|  |   | <b>Assessment</b> | <b>Percentage Marks</b>   |
| In-Course  | Assignments/ Course work                        |                   | 40  |
|  | Mid Semester Examination                        |                   | -   |
| End of Semester Examinations   |   |                   | 60  |

|   |   |                         |
|---|---|-------------------------|
| <b>Course Code</b>  | : CE 6512   |                         |
| <b>Course Title</b>   | : Forensic Investigation, Repair and Retrofitting of Structures |                         |
| <b>No. of Credits</b>   | : 2   |                         |
| <b>Pre-requisites</b>   | : None  |                         |
| <b>Compulsory/Optional</b>  | : Optional  |                         |
| <b>Aim(s):</b> The objective of this course is to develop a sound knowledge on forensic investigation, damage assessment, repair and retrofitting of steel and concrete structures.   |   |                         |
| <b>Intended Learning Outcomes:</b><br>At the end of this course, students should be able to;  |   |                         |
| <ol style="list-style-type: none"> <li>1. Describe the failure mechanisms of structures</li> <li>2. Analyse the present condition and strength of existing concrete and steel structures</li> <li>3. Design repairing and retrofitting methods for damaged structures</li> </ol>  |   |                         |
| <b>Time Allocation (Hours)</b>  | Lectures: 26  | Tutorials: 03           |
|   | Practicals: -   | Assignments: 02         |
|   | Independent learning: 69 (Notional hours=100)                   |                         |
| <b>Course Content/Course Description:</b>   |   |                         |
| <b>Introduction:</b><br>Role of expert witness, forensic investigation, damage assessment techniques.   |   |                         |
| <b>Failures in Civil Engineering Structures:</b><br>Technical, structural and non-structural failures. Natural hazards and unusual loads: effects on the built environment.   |   |                         |
| <b>Failure Mechanisms and Guidelines:</b><br>Failure mechanisms in concrete and steel elements and structures. Guidelines for Failure Investigation.  |   |                         |
| <b>Forensic Investigation and Damage Assessment:</b><br>Investigation of damaged or failed structures, assessment of damage, case studies.  |   |                         |
| <b>Strength Evaluation of Existing Concrete and Steel Structures:</b><br>Preliminary investigation (review of existing information and condition survey and evaluation).<br>Assessment of loading conditions and selection of evaluation method.  |   |                         |
| <b>Methods for Assessing Properties of Concrete and Steel:</b><br>Visual inspection. Detailed investigation: Stress-wave propagation methods, Infrared thermography, Ground-penetrating radar (GPR), Electrical and magnetic methods for reinforcement, Surface hardness test and coring for concrete, tensile, impact and hardness testing for steel, microstructure and crack investigation of steel, corrosion, fatigue testing. |   |                         |
| <b>Repair of Concrete and Steel Elements:</b><br>Causes, control and evaluation of cracking of concrete, methods of crack repair. Fatigue assessments, evaluation of crack initiation and propagation of steel, repair methods.   |   |                         |
| <b>Strengthening and Stabilization of Concrete and Steel Structures:</b><br>Techniques consideration, beam shear capacity strengthening, shear transfer strengthening, stress reduction techniques, column strengthening, flexural strengthening, connection stabilization and strengthening, design and construction of externally bonded FRP systems.   |   |                         |
| <b>Recommended Texts</b>  |   |                         |
| Robert, T. R., (2010), " <a href="#">Forensic Structural Engineering Handbook</a> ", 2nd Edition, McGraw-Hill.  |   |                         |
| Henry, P., (1994), " <a href="#">Design Paradigms: Case Histories of Error and Judgment in Engineering</a> ", Cambridge University Press.   |   |                         |
|   | <b>Assessment</b>   | <b>Percentage Marks</b> |
| In-Course   | Assignments/Course work (take home)                             | 50                      |
| End of Semester Examinations  |   | 50                      |

|  |   |   |
|--|---|---|
| <b>Course Code</b>   | : CE 6513                               |   |
| <b>Course Title</b>  | : Numerical Methods for Civil Engineers |   |
| <b>No. of Credits</b>  | : 2                                     |   |
| <b>Pre-requisites</b>  | : -                                     |   |
| <b>Compulsory/Optional</b>   | : Optional                              |   |
| <b>Aim(s):</b> To introduce numerical methods for solving mathematical models of Civil Engineering problems.   |   |   |
| <b>Intended Learning Outcomes:</b><br>On successful completion of the course, the students should be able to;  |   |   |
| <ol style="list-style-type: none"> <li>1. Explain numerical methods for solving simultaneous equations, finding roots of equations, interpolation and curve fitting.</li> <li>2. Apply numerical methods for solving ordinary and partial differential equations.</li> <li>3. Develop suitable algorithms for solving partial differential equations.</li> </ol>   |   |   |
| <b>Time Allocation (Hours):</b>  | Lectures: 26                            | Tutorials: 02      Practicals: 04<br>Assignments: 04<br>Independent learning: 68 (Notional hours=100) |
| <b>Course content/Course description:</b>  |   |   |
| <ul style="list-style-type: none"> <li>• <b>Solutions to nonlinear equations:</b> bisection method; method of false position; fixed-point iteration; Newton-Raphson's method; secant method.</li> <li>• <b>Numerical solutions to systems of linear equations:</b> Gaussian elimination; Jacobi method; Gauss Seidel method</li> <li>• <b>Interpolation:</b> Linear interpolation; Newton interpolation; Lagrange interpolation; Spline interpolation.</li> <li>• <b>Approximation and curve fitting:</b> Linear regression; polynomial regression;</li> <li>• <b>Numerical solutions to ordinary differential equations:</b> Initial value problems: Euler method, Runge-Kutta methods; Boundary value problem: Finite difference method</li> <li>• <b>Numerical solutions for partial differential equations:</b><br/><b>Finite difference method:</b> Elliptic equations: 1D and multi-dimensional problems; parabolic problems;<br/><b>Integral Equation Methods:</b> Collocation method, Galerkin method and Weighted Residual method ; Numerical Quadrature: Gaussian Quadrature.</li> </ul> |   |   |
| <b>Recommended Texts :</b><br>C. Chapra and R.P.Canale, (2000). <i>Numerical Methods for Engineers</i> , 5 <sup>th</sup> edition, McGraw-Hill.   |   |   |
| <b>Assessment</b>  |   | <b>Percentage Mark</b>  |
| In-course  | Tutorials/Quizzes                       | 40  |
| End of Semester Examinations   |   | 60  |



|  |                                 |   |
|--|---------------------------------|---|
| <b>Course Code</b>   | : CE 6514                       |   |
| <b>Course Title</b>  | : Design of High-Rise Buildings |   |
| <b>No. of Credits</b>  | : 2                             |   |
| <b>Pre-requisites</b>  | : Structural Dynamics           |   |
| <b>Compulsory/Optional</b>   | : Optional                      |   |
| <b>Aim(s):</b> To train graduate students with advanced knowledge of multi-disciplinary aspects on modelling, analysis, design and construction of High-Rise buildings.  |                                 |   |
| <b>Intended Learning Outcomes:</b><br>At the end of this course, students should be able to;   |                                 |   |
| <ol style="list-style-type: none"> <li>1. Explain the basic structural configurations for vertical and lateral load resistance system of high-rise buildings</li> <li>2. Describe building services and design philosophy for high-rise buildings</li> <li>3. Evaluate the behaviour of high-rise buildings against wind and earthquake loadings</li> <li>4. Analyse and design structural systems of high-rise buildings</li> </ol> |                                 |   |
| <b>Time Allocation (Hours)</b>   | Lectures: 24                    | Tutorials: - Practical: - Assignments: 12<br>Independent learning: 64 (Notional hours =100) |
| <b>Course Content/Course Description:</b>  |                                 |   |
| <b>Introduction to High-Rise Building:</b><br>What is "High-Rise building"?, Different High-Rise building systems, Function of service core, Required professional skills, Special consideration of High-Rise building design  |                                 |   |
| <b>Design Process and Philosophy:</b><br>Structural design considerations, Overall design process, Structure design process, Design philosophy and process, Proportioning for safety, Philosophies in current use, From serviceability to performance  |                                 |   |
| <b>Building Systems:</b><br>Knowledge model for system selection, Determining system suitability, Evaluating system suitability, Assigning suitability values, Selection of structural system, Typical characteristics of residential buildings and commercial buildings, The building structural system (physical and conceptual)   |                                 |   |
| <b>Structural Load Resisting Systems:</b><br>Vertical load resisting systems, Lateral Load Resisting Systems, Selection of Lateral Load Resisting Systems  |                                 |   |
| <b>Performance based Concept for High-Rise Buildings:</b><br>Performance based design of new High-Rise buildings, Performance based evaluation of existing High-Rise buildings   |                                 |   |
| <b>Modeling, Analysis and Design for Lateral Loads:</b><br>Computer modeling for accurate analysis (SAP 2000), Analysis and design of shear walls, Analysis and design of transfer girders and deep beams, Analysis and design of High-Rise building for wind loading, Analysis and design of High-Rise building for seismic loading   |                                 |   |
| <b>Recommended Texts</b><br>Smith, B. S. and Coull, A. 1991, <i>Tall building structures</i> , John Wiley (or any new edition).  |                                 |   |
| <b>Assessment</b>  |                                 | <b>Percentage Marks</b>   |
| In-Course  | Mini project:                   | 40  |
| End of Semester Examinations   |                                 | 60  |

|  |  |                   |   |
|--|--|-------------------|---|
| <b>Course Code</b>   | : CE 6515                                  |                   |   |
| <b>Course Title</b>  | : Bridge Engineering                       |                   |   |
| <b>No. of Credits</b>  | : 2  |                   |   |
| <b>Pre-requisites</b>  | : Design of reinforced concrete structures |                   |   |
| <b>Compulsory/Optional</b>   | : Optional                                 |                   |   |
| <b>Aim(s):</b> To improve the professional exposure towards Bridge Engineering aspects.  |  |                   |   |
| <b>Intended Learning Outcomes:</b><br>At the end of this course, students should be able to;   |  |                   |   |
| <ol style="list-style-type: none"> <li>1. Explain different structural configurations of bridges and select suitable bridge type for a given project by reviewing techno economic feasibilities of different alternatives.</li> <li>2. Analyse the bridge decks for code defined traffic and other loadings.</li> <li>3. Design substructure elements, superstructure elements bearings and expansion joints.</li> <li>4. Evaluate the performance of existing bridges through monitoring practices and suggest appropriate maintenance, repair and rehabilitation schemes.</li> </ol> |  |                   |   |
| <b>Time Allocation (Hours)</b>   | Lectures: 27                               | Tutorials: 06     | Practicals: 06<br>Assignments: 06<br>Independent learning: 67 (Notional hours =100) |
| <b>Course Content/Course Description:</b>  |  |                   |   |
| <b>Design considerations</b><br>Economical consideration; site selection; aesthetics; geotechnical investigations; hydrological and hydraulic considerations; safety considerations  |  |                   |   |
| <b>Alternative structural configurations and systems</b><br>Use of different materials, Constructability, Modern concepts, FEM applications, Construction methods  |  |                   |   |
| <b>Bridge deck loading and analysis</b><br>Guidelines and Codes of Practices in highway and railway bridge design including Sri Lankan practices   |  |                   |   |
| <b>Design of superstructure:</b><br>Reinforced concrete bridges; Pre-stressed concrete bridges; Steel bridges; Steel-concrete composite bridges<br>Design exercise is based on a selected bridge type  |  |                   |   |
| <b>Design of substructure:</b><br>Abutments; piers; piles and other foundations  |  |                   |   |
| <b>Design of bearings and joints</b><br>Design of Elastomeric bearing, Bridge expansion joints   |  |                   |   |
| <b>Dynamic Analysis of Bridges</b><br>Structural dynamics for bridges, seismic effects, wind effects   |  |                   |   |
| <b>Maintenance of bridges:</b><br>Scheme of inspection; identification of defects and repair methods   |  |                   |   |
| <b>Recommended Texts</b><br>RDA Bridge Design Manual<br>Essentials of Bridge Engineering, 4 <sup>th</sup> Ed, D.J. Victor, Oxford & IBH Publishing, 1973<br>Bridge Engineering, S. Ponnuswamy, Tata McGraw-Hill Publishing, 1986<br>Bridge & Structure Estimating, J.D.Nardon, McGraw-Hill Publishing, 1995<br>Eurocode specifications: EN 1990 - EN 1994, EN 1997   |  |                   |   |
|  |  | <b>Assessment</b> | <b>Percentage Marks</b>   |
| In-Course  | Assignments/Course work                    |                   | 40  |
| End of Semester Examinations   |  |                   | 60  |

|   |                        |  |
|---|------------------------|--|
| <b>Course Code</b>  | : CE 6102              |  |
| <b>Course Title</b>   | : Independent Study    |  |
| <b>No. of Credits</b>   | : 3                    |  |
| <b>Pre-requisites</b>   | : None                 |  |
| <b>Compulsory/Optional</b>  | : Compulsory           |  |
| <b>Aim(s):</b> To train the students to carry out a literature review, identify a research gap/complex engineering problem, formulate a methodology and present the preliminary findings.   |                        |  |
| <b>Intended Learning Outcomes:</b><br>On successful completion of the course, the student should be able to;  |                        |  |
| <ol style="list-style-type: none"> <li>1. search for technical literature and information from various sources and conduct a review.</li> <li>2. formulate a research/complex engineering problem based on the identified knowledge gap and develop appropriate methodology to solve the problem.</li> <li>3. carry out a preliminary analysis based on the developed methodology.</li> <li>4. write a report and present the findings in a precise and coherent manner with all relevant information.</li> </ol> |                        |  |
| <b>Time Allocation (Hours)</b>  | Notional hours = 300   |  |
| <b>Course Content/Course Description:</b>   |                        |  |
| <b>Self-studies:</b><br>Search of technical literature, identify the knowledge gap, formulate aim, objectives and scope, develop a methodology, collect data, carry out a preliminary analysis, and present the findings in the form of presentations and a report.   |                        |  |
| <b>Meetings with supervisor:</b><br>Conduct progress meetings with the supervisor, discuss the progress, and receive feedback from the supervisor for the presentation and report.  |                        |  |
| <b>Recommended Texts</b><br>Geoffrey R.M., David D., David F., (2005). "Essentials of Research Design and Methodology", John Wiley & Sons.<br>Creswell J. W., David J. C., (2017). "Research Design: Qualitative, Quantitative, and Mixed Methods", John SAGE Publications.   |                        |  |
| <b>Assessment</b>   | <b>Percentage Mark</b> |  |
| <b>In-Course</b>  |                        |  |
| <b>Progress evaluations:</b>  |                        |  |
| <b>Three progress evaluations:</b>  | 30                     |  |
| Progress evaluation 1: Oral presentation 1  |                        |  |
| Progress evaluation 2: Oral presentation 2  |                        |  |
| Progress evaluation 3: Oral presentation 3  |                        |  |
| <b>Final Evaluation:</b>  |                        |  |
| Final report  | 40                     |  |
| Presentation  | 30                     |  |

|                            |                  |
|----------------------------|------------------|
| <b>Course Code</b>         | : CE 6103        |
| <b>Course Title</b>        | : Advanced Study |
| <b>No. of Credits</b>      | : 5              |
| <b>Pre-requisites</b>      | : None           |
| <b>Compulsory/Optional</b> | : Compulsory     |