SYLLABUS PHD

CIVIL ENGINEERING

JANUARY 1, 2020

IUST AWANTIPORA

This is Syllabus for courses for Degree leading to PhD in Civil Engineering. It is designed as per PhD Ordinance of IUST Awantipora (designed in terms of Section 14 and 16 of University Act) and as per UGC guidelines.

The Syllabus has two Components Component I and Component II. The credits assigned to Ph.D. course work shall be 8. The breakup of the course work is given below:

1. The course work shall be a prerequisite for Ph.D. and shall have two components of minimum 4 Credits each. Component one has courses on Research Methodology which would cover areas such as quantitative methods, computer applications, research ethics and review of published research in the relevant field, training, field work, etc. Component two will have subject specific courses which may be completed in the University or any other institution of repute with which the University has a credit transfer arrangement for research & development.

2. All courses prescribed for Ph.D. course work shall be in conformity with the credit hour instructional requirement and shall specify content, instructional and assessment methods.

3. The Department where the scholar pursues his/her research shall prescribe the course(s) to him/her based on the recommendations of the SRAC.

4. All candidates admitted to the Ph.D. programme shall be required to complete the course work prescribed by the DRC during the initial one or two semesters.

5. A Ph.D. scholar shall have to obtain a minimum of 7 CGPA in the course work to be eligible to continue in the programme and submit the dissertation/thesis.

6. The candidate has to register for one course from Component I and one course from Component II during first two semesters of the Degree.

Contents

NAME OF DEPTT : Department of Civil Engineering

1. Subject Code : CEN-801 Course Title : Modelling, Simulation and Optimization
2. Contact Hours : L: 3 T:1 P:0
3. Examination Duration (Hrs) : Theory : 2.5 Practical : 0
4. Credits : 4 5. Semester: - 6. Subject Area : Component I
7. Pre-requisite: Nil

8. Objective: To introduce the fundamentals of modelling, simulation and optimization techniques in Civil Engineering. A Quantitative Method Description of Studying

9. Details of Course:

S. No.	Contents	Contact Hours
1.	Systems and Models: Fundamentals of systemic approach, system modeling, classification of models, model structure, Linear, non-linear, time-invariant, time variant models, State-space models, Distributed parameter models, System Synthesis, Direct and inverse problems, Role of optimization, Role of computers, examples from hydrology/water resources engineering	8
2.	Regression Analysis: Linear and Multiple Regression analysis, analysis of residues, tests of goodness of fit, Parsimony criterion, role of historical data, examples from Spatial Distribution: Polynomial surfaces, Kirging, Spline functions, Cluster Analysis	8
3.	Time Series Analysis: Auto-cross correlation analysis, identification of trend, spectral analysis, identification of dominant cycles, smoothening techniques, Filters, time series of rainfall and stream flow.	8
4.	Random variables: Basic concepts, probability density distribution functions, Expectation and standard deviation of discrete and continuous random variables and their functions, covariance and correlation, commonly used theoretical probability distributions (uniform, normal, binomial, poisson's and negative exponential), Fitting distributions to raw data, Chi-square and Kolmogrov-Smirnov;s tests of the goodness of fit, Central limit theorem, various algorithms for generation of random numbers	8
5.	Monte Carlo simulation: basic concepts, generation of synthetic observations, statistical interpretation of output, Evaluation of definite integrals, Optimization: Introduction, Classical methods, Linear Programming	10
	Total	42

10. Suggested Books

S. No.	Name of Authors/Books/Publishers	Year of Publication/ Reprint
1.	Law, A.M. and Kelton, W.D., "Simulation Modeling and Analysis", Tata McGraw Hill.	2007
2.	Daniel, C. and Wood, P.S., "Fitting Equations to Data", John Wiley.	1980

3.	Ljung, L., "System Identification Theory for the Users", Prentice Hall.	1999
4.	Rao S. S., "Engineering Optimization,Theory and Pratice", New Age International Publishers.	2012
5	Deb, K., "Optimization for Engineering design", Prentice Hall of India.	2006
6	Vedula S. and Mujumdar P. P. "Water Resources Systems", Tata McGraw Hill.	2005

NAME OF DEPTT : Department of Civil Engineering

1. Subject Code : CEN-802 Course Title : Engineering Design Optimization and Reliability
2. Contact Hours : L: 3 T : 0 P: 2
3. Examination Duration (Hrs) : Theory : 2.5 Practical : 0
4. Credits : 4 5. Semester: - 6. Subject Area : Component I
7. Pre-requisite: Nil

8. Objective: This course is designed to introduce students to concepts and applications of structural reliability and design optimization. Upon completion of this course, students will be able to: (a) Compute first- and second-order estimates of failure probabilities of engineered systems; (b) Compute sensitivities of failure probabilities to assumed parameter values; (c) Measure the relative importance of the random variables associated with a system; (d) Update reliability estimates based on new observational data; (e) Identify the relative advantages and disadvantages of various analytical reliability methods, as well as Monte Carlo simulation; (f) Use reliability tools to calibrate simplified building codes

9. Details of Course:

S. No.	Contents	Contact Hours
1	Introduction to Design Optimization; Optimal Design Problem Formulation; Graphical Optimization and Basic Concepts, Optimum Design Concepts: Optimality Conditions; Optimal Design with MATLAB	8
2	Numerical Methods for Unconstrained Design Optimization; Numerical Methods for Constrained Design Optimization; Practical Applications of Optimization	8
3	Genetic Algorithm for Optimum Design; Multi-objective Optimum Design Concepts and Methods	8
4	Fundamentals of probability theory; Common probabilistic models	2
	General component reliability; First-order second-moment methods; First and Second-order reliability method	9
5	Importance measures and parameter uncertainty; Sampling techniques; Surrogate Modelling	4
	Development of reliability based design codes; System reliability	3
	Total	42

10. Suggested Books:

S. No.	Name of Authors/Books/Publishers	Year of Publication/ Reprint
1.	Jasbir S. Arora, “Introduction to Optimum Design”, 3rd Ed., Academic Press.	2012
2.	Achintya Halder and Sankaran Mahadevan, “Probability, Reliability, and Statistical Methods in Engineering Design”, John Wiley.	2000
3.	O. Ditlevsen, and H. O. Madsen, “Structural Reliability Methods”, Internet Edition 2.3.7, John Wiley. http://www.web.mek.dtu.dk/staff/od/books.htm	2007
4.	A.H.S. Ang and W. H. Tang, “Probability Concepts in Engineering Planning and Design”, Vol. I : Basic Principles, Wiley.	1975
5.	R. E. Melchers, “Structural Reliability Analysis and Prediction”, 2nd Ed., Wiley.	1999

NAME OF DEPTT : Department of Civil Engineering

1. Subject Code : CEN-803 Course Title : Theory of Elasticity
2. Contact Hours : L: 3 T : 1 P: 0
3. Examination Duration (Hrs) : Theory : 2.5 Practical : 0
4. Credits : 4 5. Semester: - 6. Subject Area : Component II
7. Pre-requisite: Nil
8. Objective: This course provides a comprehensive introduction to the Theory of Elasticity in a simple form as the subject allows together with a compilation of solutions of special problems that are important in engineering practice and design.
9. **Details of Course:**

S.No.	Contents	Contact Hours
1	Introduction, Introduction to Tensor, Concept of Stress and Strain	8
2	Constitutive Relationships , Formulation of Boundary Value Problems	10
3	Solution of Boundary Value Problems, Problems in Flexure	8
4	Boundary Value Problems in Elasticity, Complex Variable Method	10
5	Thermo-Elasticity, Photo-Elasticity, Introduction to non-linear elasticity.	8
	Total	44

10. Suggested Books:

S. No.	Name of Authors/Books/Publishers	Year of Publication/ Reprint
1.	H. Jane Helena, "Theory of Elasticity and Plasticity", PHI Learning Private Limited.	2017
2.	Stephen Timoshenko and J.N.Goodier, "Theory of Elasticity"	2017

NAME OF DEPTT : Department of Civil Engineering

1. Subject Code : CEN-804 Course Title : Maintenance and Repair of Concrete Structures
2. Contact Hours : L: 3 T : 1 P: 0
3. Examination Duration (Hrs) : Theory : 2.5 Practical : 0
4. Credits : 4 5. Semester: - 6. Subject Area : Component II
7. Pre-requisite: Nil

8. Objective: This course enables to study the Maintenance and Repair of Concrete Structures where deterioration occurs by environmental actions like corrosion, fire. Its objective is to determine the strengthening methods and repair techniques for deteriorated structure.

9. Details of Course:

S.No.	Contents	Contact Hours
1	Prologue, Corrosion of Embedded Metal, Significance and Fundamentals of Corrosion, Carbonation induced and Chloride Induced Corrosion, Corrosion of embedded metal, Types of Reinforcement i.e. Bare Steels, etc.. Ring test for assessing the quality of TMT steel bars; Corrosion of metallic and non-metallic coated re-bars; corrosion in pre-stressed concrete	8
2	Deterioration of Cementitious Systems, Introduction, Sulphate attack, bio-fouling and acid attack; deterioration of cementitious systems, freeze-thaw and alkali-silica reaction; Deterioration by Shrinkage and creep. Fire attack, abrasion and erosion; condition assessment of concrete structures: Exposure conditions, visual inspection and on-situ concrete testing. Testing of concrete in Laboratory.; Mechanical and corrosion testing of re-bars, strategies and materials for concrete repair,	10
3	Surface preparation and Protective treatments, Coatings on concrete infrastructures, water-proofing of concrete structures	8
4	Structural Strengthening & Stabilization- Load effects and Introduction to S&S; Structural Strengthening & Stabilization - Beams and Slabs; Structural Strengthening & Stabilization - Columns & Walls, Joints and connections strengthening, Injection Grouts for concrete repair, Structural repair of pre-stressed concrete systems	10
5	Case studies on structural repair (Right methodologies and systematic approach / case studies), Cathodic Protection in Concrete Structures - Laboratory and field studies, Service life estimation	8
	Total	44

10. Suggested Books:

S. No.	Name of Authors/Books/Publishers	Year of Publication/ Reprint
1.	Modi Poonam I. (Author), Patel Chirag N. (Author), "Repair And Rehabilitation Of Concrete Structures", PHI	2016
2.	D.Campbell- Allen (Author), Harold Roper (Author), Denison Campbell-Allen (Author), "Concrete Structures: Materials, Maintenance and Repair (Concrete design & construction series)"	1991

NAME OF DEPTT : Department of Civil Engineering

1. Subject Code : CEN-805 Course Title : Characterisation of Construction Materials
2. Contact Hours : L: 3 T : 1 P: 0
3. Examination Duration (Hrs) : Theory : 2.5 Practical : 0
4. Credits : 4 5. Semester: - 6. Subject Area : Component II

10. Pre-requisite: Nil
11. Objective:
12. Details of Course:

S.No.	Contents	Contact Hours
1	Characterization of Construction Materials: An Introduction; Structure of Construction Materials: An Overview; Calorimetry: Introduction and types of Calorimeter, Calorimetry: Sample preparation, Practical note and Heat of hydration, Calorimetry: Applications of calorimetry.	8
2	X Ray diffraction: Introduction to X Rays and crystallography, X Ray diffraction: Crystal systems and History of XRD, X Ray diffraction: Diffractogram, X Ray diffraction: Diffractogram – Calculations; X Ray Diffraction: Qualitative Phase Analysis, X Ray Diffraction: Sample Preparation and Application in study of cements	8
3	Thermal Analysis, Application of thermal analysis to study construction materials, Surface Area Measurement: Sampling and particle size distribution, Surface Area Measurement: Different techniques, Surface Area Measurement: calculation and applications, Porosity and pore structure - Introduction, significance of pore distribution, Porosity and pore structure - Woking of mercury intrusion porosimeter.	8
4	Optical and Scanning Microscopy- Introduction and specimen preparation, Optical and Scanning Microscopy- Features and functions, Types of optical microscopy, Scanning electron microscope Part 1- Parts and Functioning; Scanning electron microscope Part 2- Working Principles; Scanning electron microscope Part 3 - Analysis of cementitious systems	10
5	Application of characterization techniques to assess composite binder with limestone-calcined clay: what, why and how? Image analysis - Introduction and image mapping, Image analysis - Basic operations, Spectroscopy Techniques; Electrical Impedance analysis - Principle and different methods, Electrical Impedance analysis - Deliverables and Interpretation, Electrochemical testing (Corrosion) using Electrochemical Impedance Spectroscopy (EIS)	10
	Total	44

10. Suggested Books:

S. No.	Name of Authors/Books/Publishers	Year of Publication/ Reprint
1.	"Materials Characterization Techniques" by Sam Zhang et al, CRC Press	2009
2.	Yang Leng, "Materials Characterization: Introduction to Microscopic and Spectroscopic Methods" Wiley	2020