

Punyashlok Ahilyadevi Holkar Solapur University, Solapur



NAAC Accredited-2015
'B' Grade (CGPA 2.62)

Name of the Faculty: Science & Technology

CHOICE BASED CREDIT SYSTEM

Syllabus: Civil Engineering

Name of the Course: Ph. D. Course Work Paper No. 3

(Syllabus to be implemented from w.e.f. June 2021)

Punyashlok Ahilyadevi Holkar
Solapur University, Solapur



Ph. D. Course Work Syllabus
Civil Engineering
(Faculty of Science & Technology)

Ph. D. Course Work Syllabus w.e.f. 2021-22

Paper-3 (Elective)

(Advanced Knowledge in Core domain of Civil Engineering)

- A. Advanced knowledge in Structural Engineering & Concrete Technology**
- B. Advanced knowledge in Geotechnical Engineering and Construction Management**
- C. Advanced knowledge in Environmental Engineering and Water Resources Engineering**

Note : *The candidate shall select any one 'elective' subject in consultation*

with the guide from the above list:



PUNYASHLOK AHILYADEVJI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR

Ph. D. Course Work

Paper No.-3 Advanced Knowledge in Core Domain of Civil Engineering
Elective (A) Advanced Knowledge in Structural Engineering & Concrete
Technology

Unit I: Newly Added Knowledge to Broad Understanding of Core Domain Civil Engineering

Hours-6

Marks-10

Credit- 0.5

The theoretical background of the advanced topics, which will orient Civil Engineering researchers to select advanced topics/methodology for their research:

1. Design Thinking for Civil Engineering: Need and Methodology along with Civil Engineering Case study.
2. Use of Artificial Intelligence for Civil Engineering Problems: Typical methodology for Convolution Neural Network (CNN), Application of CNN related to Mapping, Regression and Classification.
3. Various techniques for concrete testing for quality assurance
4. Environmental Impact Assessment: Environmental audit (EA), Methodology for measurement of environmental impact
5. Sustainable Development in Civil Engineering

Reference Books

- The Design of Everyday Things: Don Norman
- Deep Learning: Rajiv Chopra
- Non - Destructive Testing: Mr. T. Raja Santhosh Kumar Dr. A. Anderson, Dr. S. Ramachandran, Dr. S. Ramachandran
- Dynamic soil structure interaction : John P Wolf, Prentice Hall International series

Unit II: Advanced Development in Structural Analysis

Hours-24

Marks-40

Credit- 2.5

A) Member Oriented Stiffness Method

Stiffness matrices of beam, Truss, Plane frame. Transformation of matrices on structure axis. Overall joint stiffness matrix and nodal load vector, assembly rules. Calculation of member end forces.

B) Finite Element Analysis:

Fundamentals of finite element analysis, Stress strain relations, Strain displacement relations, Plane stress and plane strain problems. Compatibility conditions. 1-D element: 2 noded, 3 noded etc. Application of FEM for the analysis of plane truss, Continuous beam and simple plane frame problems.

References:

1. W. Weaver, J.M. Gere - "Matrix Analysis of framed structures"- CBS publishers and Distributors, 1986
2. C.S. Reddy - "Basic Structural Analysis"- Tata Mc Graw-Hill, 1996
3. Krishnamoorthy C S -, "Finite Element Analysis"- Tata McGraw Hill
4. Chadrupatla, Tirupathi R.- "Finite Element Analysis for Engineering and Technology"- University Press, India
5. S.S. Bhavikatti -"Finite Element Analysis"- New Age International Publishers, New Delhi.

Unit III: Advanced Structural Design and Concrete Technology

Hours-24

Marks-40

Credit- 2.5

A) Advanced Concrete Technology:

Design of high strength concrete mixes, Fibre reinforced concrete, Lightweight concrete, Ultra-light weight concrete, Vacuum concrete, Mass concrete, Waste material based concrete, Shotcreting, Guniting, Sulphur concrete and Sulphur infiltrated concrete, Jet cement concrete (ultra rapid hardening), Gap graded concrete, No fines concrete, High strength concrete, High-performance concrete and Underwater concreting.

B) Earthquake resistant design:

Concept of Earthquake resistant design, Provisions of seismic code IS 1893 (Part-I), Response spectrum, Design spectrum, Design of buildings, Reinforcement detailing, Provisions of IS 13920, Seismic education and retrofitting, Seismic test methods. Seismic resistant building architecture –Lateral load resistant systems

Reference Books:

1. Concrete technology by Santhakumar- Oxford University Press.
2. Concrete technology-A.M.Neville and Brooks
3. Concrete Technology- M.S.Shetty.
4. Fiber Reinforced Cement Composite- P.N.Balguru&P.N.Shah.
5. Bhavikatti, S.S. (2010), Design of Steel Structures By Limit State Method as Per IS: 800— 2007, Second Edition, I K International Publishing House, New Delhi.
6. Duggal, S. K. (2009), Earthquake Resistant Design of Structures, Oxford University Press, New Delhi
7. IS: 1893-2002, Criteria for Earthquake Resistant Design of Structures, BIS, New Delhi

Unit IV: Computational Background for Civil Engineering
(Common to all)

Hours-6

Marks-10

Credit- 0.5

A) Applications of Linear & Nonlinear Equations in Civil Engg

Solution of systems of linear and non-linear algebraic equations, Eigenvalue problems.

B) Data handling and data analysis

Various distributions: binomial, normal, log-normal, Poisson, Beta B, gamma distribution, Correlation and Regression and Multivariate Analysis: Bivariate Frequency Distribution, Scatter

Diagram, Correlation Analysis, Use of regression analysis in resources management.

References:

1. Montgomery, Douglas C. & Runger, George C. (2007), 3/e, Applied Statistics & Probability for Engineers (Wiley India)
2. Kothari C.K. (2004), 2/e, Research Methodology- Methods and Techniques (New Age International, New Delhi)
3. Numerical methods for Scientific and Engineering Computation by M.K. Jain, S.R.K Iyengar & R.K. Jain and published by Wiley Eastern Ltd.
4. Numerical methods for Engineering Computation by D.V. Griffiths and I. M. Smith published by Blackwell Scientific Publication.



PUNYASHLOK AHILYADEVJI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR

Ph. D. Course Work

Paper No.-3 Advanced Knowledge in Core Domain of Civil Engineering

Elective (B) Advanced Knowledge in Geotechnical Engineering and

Construction Management

Unit I: Newly Added Knowledge to Broad Understanding of Core Domain Civil Engineering

Hours-6

Marks-10

Credit- 0.5

The theoretical background of the advanced topics, which will orient Civil Engineering researchers to select advanced topics/methodology for their research:

1. Design Thinking for Civil Engineering: Need and Methodology along with Civil Engineering Case study.
2. Use of Artificial Intelligence for Civil Engineering Problems: Typical methodology for Convolution Neural Network (CNN), Application of CNN related to Mapping, Regression and Classification.
3. Various techniques for concrete testing for quality assurance
4. Environmental Impact Assessment: Environmental audit (EA), Methodology for measurement of environmental impact
5. Sustainable Development in Civil Engineering

Reference Books

- The Design of Everyday Things: Don Norman
- Deep Learning: Rajiv Chopra
- Non - Destructive Testing: Mr. T. Raja Santhosh Kumar Dr. A. Anderson, Dr. S. Ramachandran, Dr. S. Ramachandran
- Dynamic soil structure interaction : John P Wolf, Prentice Hall International series

Unit II: Advanced Development in Geotechnical Engineering

Hours-24

Marks-40

Credit- 2.5

(A) Foundations in weak soils and Geo-environmental Engineering

(i) Foundations in weak soils: Foundations in difficult soils: expansive soils, chemically aggressive environment, soft soils, fills, regions of subsidence.

(ii) Geoenvironmental Engineering: Landfills in ash ponds and tailing ponds. Detection, control and remediation of subsurface contamination; Engineering properties and geotechnical reuse of waste.

(B) Geotechnical Earthquake Engineering and Soil-Structure Interaction

(i) Geotechnical Earthquake Engineering: Dynamic soil properties: Measurement of dynamic soil properties using field and laboratory tests (overview), stress-strain behavior of cyclically loaded soils, strength of cyclically loaded soils. Soil Improvement for Remediation of Seismic Hazards: Densification techniques, Reinforcement Techniques, Grouting and Mixing techniques, Drainage techniques.

(ii) Soil-Structure Interaction: Free field response, Kinetic interaction, Inertial interaction, SSI models- Winkler model, Elastic Continuum, Structural analysis with SSI- Shallow foundation, Deep Foundation, Analysis of High Rise building with a fixed base and flexible base

Reference Books:

1. Bowles J E (1996), Foundation Analysis and Design, McGraw Hill.
2. Das B M (1993), Principles of Soil Dynamics, Brooks/Cole
3. Hsai-Yang Fang, Introduction to Environmental Geotechnology, CRC Press.
4. Kramer S L (1996), Geotechnical Earthquake Engineering, Prentice Hall
5. Wolf J P (1985), Dynamic Soil-Structure Interaction, Prentice-Hall

Unit III: Advanced Development in Construction Management

Hours-24

Marks-40

Credit- 2.5

(A) Project Management and Financial Aspects of Construction Projects

(i) Project Management: CPM, PERT networks, Cost/ Resource-based networks, scheduling, monitoring and updating, resource planning and allocation, LOB, network crashing, time cost trade off. Computer Application in Construction Management- Software for network analysis, CPM, PERT, GERT, decision tree analysis.

(ii) Financial Aspects of Construction Projects: Means of Finance, Working Capital Requirements, Project Cash Flow Projections and Statements, Project Balance Sheet, Profit Loss Account Statements, Concept of Debt Equity Ratio, Tax – Need and types

(B) Risk Management and Material Management

(i) Risk Management: Introduction, Principles, types, origin, risk control, Use of mathematical models: Sensitivity Analysis, Break Even Analysis, Simulation Analysis, Decision Tree Analysis, Risk identification, analysis and mitigation of project risks, Role of Insurance in Risk Management.

(ii) Material Management: Material planning, accounting and material reconciliation. Systems of material classification. Deterministic and probabilistic models and applications, ABC analysis, replenishment and replacement policies, VED analysis, lead time demand, purchase planning, EOQ model. Wastage audit at site, Site waste material management plan. Computer applications based upon available software.

Reference Books-

1. Construction Engineering and Management by. S. Seetharaman, Umesh Publications, New Delhi
2. Total Project Management- the Indian Context by P. K. Joy Macmillan India Ltd. Financial Management by Prasanna Chandra, Tata Mc Graw Hill Publications
3. Construction Project Management-Planning, Scheduling and Controlling by K. K. Chitkara, Tata McGraw Hill Publishing Company, New Delhi
4. Materials Management – Gopalkrishnan and Sunderasan, Prentice Hall Publications
5. Construction Planning, Methods & Equipment: Puerifoy – Tata McGraw Hill
6. Operations Research- Hamdy A. Taha

7. Engineering Optimization- S. S. Rao
8. Numerical Optimization, Jorge Nocedal and Stephen Wright; Springer, 2nd edition, (2006)
9. Engineering Optimization: Theory and Practice, S. S. Rao; Wiley, 4th edition, (2009)



Unit IV: Computational Background for Civil Engineering

Hours-6

Marks-10

Credit- 0.5

A) Applications of Linear & Nonlinear Equations in Civil Engg

Solution of systems of linear and non-linear algebraic equations, Eigenvalue problems.

B) Data handling and data analysis

Various distributions: binomial, normal, log-normal, Poisson, Beta B, gamma distribution, Correlation and Regression and Multivariate Analysis: Bivariate Frequency Distribution, Scatter

Diagram, Correlation Analysis, Use of regression analysis in resources management.

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Ph. D. Course Work

Paper No.-3 Advanced Knowledge in Core Domain of Civil Engineering
Elective (C) Advanced Knowledge in Environmental Engineering
and Water Resources Engineering

Unit I: Newly Added Knowledge to Broad Understanding of Core Domain Civil Engineering

Hours-6

Marks-10

Credit- 0.5

The theoretical background of the advanced topics, which will orient Civil Engineering researchers to select advanced topics/methodology for their research:

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- Dynamic soil structure interaction : John P Wolf, Prentice Hall International series

Unit II: Environmental Engineering

Hours-24

Marks-40

Credit- 2.5

A) Water Treatment & Waste Water Treatment:

i) Water Quality: Requirement, Standards, Stream & Effluent standards. Water purification, physical, chemical and biological processes. Unit operations, unit processes. Aeration, Sedimentation, Coagulation & flocculation, Filtration: Adsorption, Adsorption, Ion Exchange membrane Processes, RO, Ultra-filtration, Electro-dialysis and Disinfection.

ii) Waste Water Treatment: Wastewater Sources and characteristics, BOD progression & its formulations, Fundamentals of Design of W/W treatment systems- Primary, secondary and tertiary; ASP, Nitrification- denitrification, Ponds and aerated Lagoons, Attached Growth Biological Treatment Systems: TF, RBC, Activated Bio-filters, USAB, Expanded granular bed reactors, Sludge Digestion: anaerobic and aerobic, Wastewater reclamation and reuse, Effluent disposal.

B) Air Quality Monitoring and Control Techniques

(i) Air pollutants: Sources, classification, Combustion Processes, pollutant emission, Effects on Health, vegetation, materials, atmosphere, Reactions of pollutants, Scales of AP studies, effects as per scales, Air sampling, pollution measurement methods, Ambient air quality and emission standards, Air Act, legislation and regulations, Removal of gaseous pollutants. Particulate emission control; bio-scrubbers, bio-filters, Indoor air quality Models for Water and

(ii) Air Quality Introduction to Mathematical Models: Modeling approaches to water quality-classification and considerations in selecting models, DO model for streams, Streeter - Phelps model -oxygen 'sag' curve, Benthall oxygen demand Air quality models: Gaussian dispersion model, Regional air quality models. Transfer Recycling and Disposal Techniques of Municipal Solid Waste (MSW), Hospital Waste Management.

Reference Books:

1. Manual on water supply and Treatment ", CPHEEO, Ministry of Urban Development, GOI, New Delhi, 1999.
2. Manual on Sewerage and Sewage Development ", CPHEEO, Ministry of Urban Development, GOI, New Delhi, 1993.
3. M.J. Hammer, "Water and Wastewater Technology ", Regents/Prentice Hall, New

Jersey, 1991.

4. Wastewater Treatment and Reuse: Metcalf and Eddy.
5. Air Pollution: Stern
6. Wastewater Treatment for Pollution Control; Arceivala and DR. Asolekar
7. Industrial Wastewater Treatment: Nelson – Numero
8. Eckenfelder, W.W. (Jr.), Industrial Water Pollution Control, (2nd Ed). McGraw- Hill, 1989. ISBN: 007018903X.
9. American Water Works Association, Water Quality and Treatment: A Handbook of Community Water Supplies. McGraw Hill, 1998. ISBN: 0070015406
10. Kawamura, S., Integrated Design and Operation of Water Treatment Facilities. Wiley and Sons, 2000. ISBN: 0471350931



Unit III: Water Resource Engineering & Climate

Hours-24

Marks-40

Credit- 2.5

(A) Hydrology

Hydrology: Water resources of the world, India and Maharashtra, National Water Policy, Hydrologic cycle, estimation of missing precipitation and rain gauge density. Hydrograph theory: Unit hydrograph-derivation, flow routing, low flow analysis. Urban Hydrology - Run-off estimation – Design of Stormwater Drains.

(B) Water Resources Management & Climate

(i) Water Resources Management: Surface water resources mapping and management; Integrated river basin management, Inter river basin connectivity mapping, river diversion studies, Site suitability for surface storages and hydro-electric power plants, Digital elevation models and their applications, storage yield analysis, and reservoir sizing, Floodplain mapping and flood plain zoning, flood mitigation measures, flood water diversion for irrigation. Groundwater modeling, Preparation of groundwater prospecting and recharging maps.

(ii) Introduction to Weather, Climate and Indian Monsoon:

The atmosphere and its constituents, Synoptic observations- Surface and upper air. Tropical meteorology: Easterly Waves, ET-ITCZ, Inversion, Indian Summer Monsoon Rainfall – Monsoon Onset, Activity, Withdrawal, Breaks, Depressions, Easterly Jet Stream. Post Monsoon - Cyclones in the Indian Seas, North-East Monsoon.

Reference Books:

1. Principles of water resources planning and management – Goodman
2. Irrigation Engineering and Hydraulic Structures, Santosh Kumar Garg, Khanna Publishers
3. Groundwater Hydrology, David Keith Todd, Larry W. Mays, Wiley Publications
4. Applied Hydrology – Linsley Kolhar and Paulhas (McGraw Hill)
5. Atmosphere, Weather and Climate R.J. Barry and R.G. Chorley (Methuen Publication)
6. South West Monsoon” by Y.P. Rao (IMD Publication) .
7. Elements of meteorology by Miller, Thompson and Paterson
8. Monsoon by P.K. Das
9. Tropical Meteorology by T.N. Krishnamurthy

Unit IV: Computational Background for Civil Engineering

Hours-6

Marks-10

Credit- 0.5

A) Applications of Linear & Nonlinear Equations in Civil Engg

Solution of systems of linear and non-linear algebraic equations, Eigen value problems.

B) Data handling and data analysis

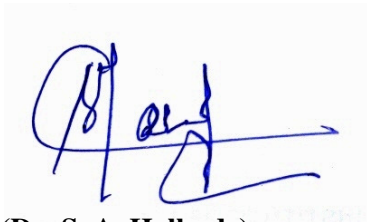
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(Dr. S. A. Halkude)

Chairman BOS in Civil Engg.

P.A.H. Solapur University Solapur