

Semester II Proposed Curriculum – M.Tech. Urban Infrastructure – IITRAM

Course	Code	Teaching Scheme & Credits
Research Methodology	CE5006	2-0-0-2
Water Resources Planning and Management	CE5007	3-0-2-4
Public Infrastructure: Planning and Design	CE5008	3-0-2-4
Pavement Design and Management	CE5009	3-0-0-3
Geosynthetics and Reinforced Earth	CE5010	3-0-0-3

Course No.	CE5006
Course Title	Research Methodology
Credits	L T P Cr 2 0 0 2
Prerequisites	---
Instructor(s)	Dr. Vikas Pratap Singh
<p>Course Contents:</p> <p>Introduction to engineering research: Definition, characteristics and types, basic research terminology, qualities of a researcher, research methods vs methodology, overview of engineering research methods, role of Information and Communication Technology (ICT) in research, research ethics, intellectual property rights and scholarly publishing.</p> <p>Research formulation: Defining and formulating the research problem, selecting the problem, necessity of defining the problem, literature survey – significance in defining a problem, various sources, critical review, identifying gap areas from literature review and research databases, development of working hypothesis.</p> <p>Research design and data analysis: Research design – basic principles, need of research design, features of good design, important concepts relating to research design, observation and facts, laws and theories, method validation, observation and collection of data, methods of data collection, sampling methods, data processing and analysis, hypothesis testing, generalization and interpretation.</p> <p>Technical writing: Types (thesis, report, journal papers etc.), qualities, structure and components of good technical document, use of software tools (Word processing, latex, etc.), illustrations and tables, bibliography, referencing and footnotes. Oral presentation – planning, software tools, creating and making effective presentation, use of visual aids, importance of effective communication.</p>	
<p>Text / References Books:</p> <ol style="list-style-type: none"> 1. Blessing, L.T.M., Chakrabarti, A., DRM, a Design Research Methodology, Springer, 2009, ISBN: 978-1-84882-586-4. 2. Chandra, S., Sharma, M.K., Research Methodology, Narosa Publishing House, 2013, ISBN: 978-81-8487-246-0. 3. Cohen, L., Manion, L., Morrison, K., Research Methods in Education, Routledge (<i>Taylor and Francis Group</i>), 2011, ISBN: 978-0-415-58336-7. 4. Goddard, W., Melville, S., Research Methodology – an Introduction, Juta and Company Ltd., 2004, ISBN: 978-0-702-15660-1. 5. Kothari, C.R., Garg, G., Research Methodology – Methods and Techniques, New Age International, 2014, ISBN: 978-81-224-3623-5. 6. Kumar, R., Research Methodology – a Step-by-Step Guide for Beginners, SAGE, 2011, ISBN: 978-1-84920-300-5. 7. Pandey, P., Pandey, M.M., Research Methodology – Tools and Techniques, Bridge Centre, 2015, ISBN: 978-606-93502-7-0. 8. Panneerselvam, R., Research Methodology, PHI Learning Pvt. Ltd., 2014, ISBN: 978-81-203-4946-9. 9. Rugg, G., Petre, M., A Gentle Guide to Research Methods, Open University Press, 2007, ISBN: 978-0-335-21927-8. 10. Singh, Y.K., Fundamentals of Research Methodology and Statistics, New Age International, 2006, ISBN: 978-81-224-2418-8. 11. Walliman, N., Research Methods – the Basics, Routledge (<i>Taylor and Francis Group</i>), 2011, ISBN: 978-0-415-48994-2. 	
Any other Remarks:	

Course No.	CE5007
Course Title	Water Resources Planning & Management
Credits	L T P C 3 0 2 4
Prerequisites	--
Instructor(s)	Dr. Manoj Langhi
Course contents:	
<p>Introduction to Water Resources Systems: Need and availability of water, technology for meeting water need, water resources planning, development and management.</p> <p>Water resources planning and development: Integrated planning, stages in water resources planning, estimation of future water demands, formulation and screening of alternatives, model for water resources planning, sensitivity analysis.</p> <p>System operation and management: Reservoir operation-basic concept and critical issues in operation, system engineering for reservoir management, real-time reservoir operation; Reservoir Sedimentation- Sediment yield of watersheds, assessment of reservoir sedimentation, methods to control sediment inflow into a reservoir.</p> <p>Water Distribution System: Distribution Reservoirs, layout and methods of distributions, design of distribution networks including pipe network analysis.</p> <p>Storm Water Collection and Distribution System: Street gutters, inlets, roadside channel, storm sewers, hydraulics of sewers, sewer system design criteria.</p> <p>River training works: Principles of river training, methods of river training, types of training works such as guide bank system, groynes or spur, deflectors, embankments or levees, cut-offs, bank protection etc.</p>	
Text / References Books:	
<ol style="list-style-type: none"> 1. Water Resources System Planning and Management, S.K. Jain and V.P. Singh, Elsevier. 2. Water Supply Engineering, Environmental Engineering Vol. I, S.K. Garg, Khanna Publishers. 3. Design of Water Supply Pipe Networks, P.K.Swamee and A.K.Sharma, Wiley. 4. River Behaviour Management and Training, Vol. I. Central Board of Irrigation and Power, New Delhi. 5. Water Resources Engineering, 3/E, David Chin, Pearson Education. 	
Any other Remarks:	

Course No.	CE5008
Course Title	Public Infrastructure: Planning and Design
Credits	L T P C 3 0 2 4
Prerequisites	--
Instructor(s)	Dr. Mahesh Mungule
<p>Course contents:</p> <p>Definitions and concept of planning, planning categories (social, economic and physical), Identification of problems and setting of goals, Objectives and priorities, planning for social infrastructure (health, education, public services and facilities), urban planning norms and standards, Planning for urban utilities</p> <p>Water Distribution System: Source identification and assessment of water demand, zoning of water system, planning and design for distribution system including storage systems, pumping stations, water distribution network, filtration and treatment plants</p> <p>Drainage System: Estimating storm water and sewerage system requirement, designing layout for sewage collection system, type and hierarchy of pipes, sewage disposal and treatment facilities</p> <p>Solid Waste: Analyzing framework for collection and transport of solid waste, considerations for location of landfill sites, incineration, composting etc</p> <p>Transport Infrastructure: Planning for main, arterial and sub-arterial road network, identifying and prioritizing the needs to different transport modes, hierarchy of roads, road cross-section, road furniture, planning considerations for community places</p>	
<p>Text / References Books:</p> <ol style="list-style-type: none"> 6. Kruckerberg and Silvers (1974), Urban Planning Analysis: Methods and Models, John Wiley & Sons, New York. 7. Chapin F.S. (1972), 'Urban Land Use Planning', University of Illinois Press, Chicago. 8. G. S. Birdie and J. S. Birdie (1990), Water Supply and Sanitary Engineering, Dhanpat Rai Publishers. 	
<p>Any other Remarks:</p> <p>Evaluation Scheme:</p> <p style="padding-left: 40px;">Theory- 40 %</p> <p style="padding-left: 40px;">Project- 60%</p> <p>Each student is expected to undertake two projects one in greenfield development and another one in brownfield development. The evaluation for the project will be done on regular basis</p>	

Course No.	CE5009
Course Title	Pavement Design and Management
Credits	L T P C 3 0 0 3
Prerequisites	Transportation Engineering
Instructor(s):	Dr. Yogesh U. Shah

Course contents:

Introduction to Pavement Design: Definition: Pavement, Desirable Characteristics Of Pavement, Pavement Types – Flexible and Rigid, Pavement Courses and its Function, Comparison: Flexible and Rigid Pavement, Comparison: Highway and Runway Pavements, Factors affecting pavement design, Pavement materials.

Stresses and strains in Flexible Pavements: Layered System Concepts, One-layer, Two-layer, Three-layer system.

Design of Flexible Pavements: Design of flexible pavements as per IRC 37 and other methods for stabilized and un-stabilized base and subgrade layers.

Stresses and Deflections in Rigid Pavements: Stresses due to loading, Stresses due to temperature changes (Curling), Stresses due to friction, Stresses due to reinforcement, Design of Joints.

Design of Rigid Pavements: Design of rigid pavements as per IRC 58 for stabilized and un-stabilized base and subgrade layers.

Pavement Management System : Pavement Distresses, Pavement Evaluation, Strengthening of Existing Pavement

Text / References Books /Manuals:

1. Y.H. Huang. Pavement Analysis and Design, 2nd Edition, 2004, Pearson Prentice Hall, USA
2. E.J. Yoder & M.W. Witczak. Principles of Pavement Design, 2nd Edition, 2011, John Wiley & Sons.
3. L.R. Kadiyali & N.B. Lal. Principles and Practices of Highway Engineering, 6th Edition 2013, Khanna Publishers, New Delhi.
4. MORT&H- Specifications for Roads and Bridges, 5th Revision, 2013.
5. IRC: 37-2012. Tentative Guidelines for the Design of Flexible Pavements, Indian Road Congress, Delhi.
6. IRC: 58-2011. Tentative Guidelines for the Design of Rigid Pavements, Indian Road Congress, Delhi.
7. IRC: 81-2012. Guidelines for Strengthening of Flexible Road Pavements Using Benkelman Beam Deflection Technique, Indian Road Congress, Delhi
8. IRC: SP: 76-2008. Tentative Guidelines for Conventional, Thin and Ultra-Thin White-topping, Indian Road Congress, Delhi.

Course No.	CE5010
Course Title	Geosynthetics and Reinforced Earth
Credits	L T P C 3 0 0 3
Prerequisites	Soil Mechanics, Foundation Engineering
Instructor(s)	Dr. Trudeep N. Dave
Course contents	
<ol style="list-style-type: none"> 1. Introduction: Geosynthetics classification – on the basis of functions, applications, raw materials used, types, manufacturing, system, design and sustainability; Background of reinforced earth, mechanism and concepts, Basis of reinforced earth wall design. 2. Reinforced Soil Retaining Walls: Different types of walls like wrap-around walls, full height panel walls, discrete-facing panel walls, modular block walls, design methods as per Codes, construction methods for reinforced soil retaining walls 3. Geosynthetics - Reinforced Slope Application: Guidelines for design of reinforced slopes, Basal reinforcement for construction on soft clay soils, construction of steep slopes with reinforcement layers, different slope stability analysis methods like planar wedge method, bi-linear wedge method, circular slip methods, erosion control on slopes using geosynthetics 4. Geosynthetics - Drainage and Filtration Applications: Different filtration requirements, filtration in different types of soils and criteria for selection of geotextiles, estimation of flow of water in retaining walls, pavements, etc. and selection of geosynthetics 5. Geosynthetics - Pavement Application: Geosynthetics for separation and reinforcement in flexible pavements, Design by Giroud-Noiray approach, reflection cracking and control using geosynthetics 6. Analysis of RE Structures using Computation Tools 	
Text / References Books:	
<ol style="list-style-type: none"> 1. Koernar, R. M. (2005) Designing with geosynthetics, 5th Edition, Prentice Hall, New Jersey, USA. 2. Shukla, S. K. and Yin, J. H. (2006) Fundamentals of Geosynthetic Engineering, Taylor and Francis, UK. 3. Shukla, S. K. (2002) Geosynthetics and Their Applications, Thomas Telford, London. 4. Recently Published Technical Literature 	
Any other Remarks	