

Course syllabus

Department of Civil Engineering, Indian Institute of Technology Madras

CE5013 - Bituminous Technology

Credit Distribution: C:9 L:3 T:0 P:0 E:0 O:6 TH:0

Course Type: Theory

Description: The main objective of this course is to explore different aspects of bituminous binder and mixture production, material characterization and design techniques.

Course Content: Introduction to refinery processing of bitumen - Physical and chemical characterization of bitumen. Aging of bitumen, Binder properties and their relationship to pavement performance. Bituminous Emulsions - Manufacture, physical and rheological characteristics of emulsion and polymer modified emulsions. Breaking of emulsions, Emulsion residue recovery process - Tests on Emulsions. Modification of bitumen, Various manufacturing process for modified binders such as polymers and rubbers. Thermodynamics, compatibility, phase diagrams for modified binders. Solubility calculations - Guidelines on the use of modified binders in pavement construction. Review of different grading systems for unmodified and modified binders - International best practices and Indian specifications. Design of aggregate gradations. Introduction to particle packing theories, Discrete and continuous models - Bailey Method - Application to Bituminous Mixtures. Introduction to Rheology, Linear viscoelasticity, Review of mechanical models for bitumen, modified bitumen and bituminous mixtures - Relationship between binder and mixture rheology and pavement performance. Dynamic mechanical analysis of binders and mixtures. Material characterization techniques for binders and mixtures. Performance based mixture design. Recent trends in asphalt technology - Introduction to warm mix and developments in cold mix technologies, additives and modifiers.

Text Books:

- R. Kim, Modeling of Asphalt Concrete, ASCE Press, 2010.
- Roberts, Kandhal, Brown, Lee, and Kennedy, Hot Mix Asphalt Materials, Mixture Design and Construction, NAPA, 2009.
- Barth, Asphalt - Science and Technology, Gordon and Breach, 1962.
- The Asphalt Handbook, Asphalt Institute, 7th Edition, MS-4, 1989.
- T.F. Yen and G.V. Chilingarian, Asphaltenes and Asphalt, Elsevier, 2000.
- A. Usmani, Asphalt Science and Technology, Marcel and Dekker, 1997.
- W.N. Findley, J. S. Lai, and K. Onaran, Creep and relaxation of nonlinear viscoelastic materials, Dover Publications, New York, 1989.

Reference Books:

- Proceedings of the Association of Asphalt Paving Technologists.
- Relevant NCHRP reports.
- ASCE/TRB papers.

Prerequisite: NIL