



# PAVEMENT MATERIALS (UNDER PAVEMENT ENGINEERING)

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**PRE-REQUISITES :** Any B.Tech (Civil), M.Tech (Transportation) or PhD (Pavement Materials) student can take this class

**INTENDED AUDIENCE :** Students (B.Tech/M.Tech/PhD); Engineers; Practitioners; Faculty Members

**INDUSTRY SUPPORT :** Industries/Stakeholders related to Highway Construction: NHAI, MoRTH, IRC, PWD, PMGSY etc.

### COURSE OUTLINE :

The course on Pavement Materials will deal with the basic and fundamental understanding about the behavior of various materials used in the construction of pavements. Characterization, tests and engineering properties of these materials will be elaborated in context with its field application. Current practices and future trends in the area of pavement materials will be discussed. It is envisaged that this course will help in training students/engineers/faculty members in the domain of material engineering related to pavement application.

### ABOUT INSTRUCTOR :

Prof. Nikhil Saboo is as an Assistant Professor in the Department of Civil Engineering at IIT Roorkee. He served as an Assistant Professor at BITS Pilani, Rajasthan, from 2016-2017, and at IIT(BHU) Varanasi from 2017-2021. He completed his M.Tech from IIT Kharagpur (2012), and PhD from IIT Roorkee (2016). He has more than 8 years of experience in the area of Pavement Engineering. Some of his areas of interest includes studies related to Pavement Materials, Rheology of Asphalt Binders, Use of Reclaimed Asphalt Pavement Material in Hot Mix Asphalt, Pavement Analysis and Design, and Pavement Evaluation. He has been working on 8 externally funded projects, funded by various organizations such as Department of Science and Technology (DST), Science and Engineering Research Board (SERB), National Rural Infrastructure Development Agency (NRIDA), Council of Science and Technology, UP (CST-UP), National Highway Authority of India (NHAI) and Ministry of Roads Transport and Highways (MoRT&H). Dr. Nikhil Saboo has published more than 38 technical papers in journals (SCI/Scopus) of repute. He has delivered more than 25 invited talks on several topics in the domain of pavement materials and design. He has various professional awards to his credit. These include best paper award at Conference of Transportation Research Group of India (CTRG)-2015, Young Scientist in Civil Engineering by Venus International Foundation, and Achievement Award for Academician / Scientist / Technologist / Innovator by Construction and Industry Development Council. He was also selected for KCC Program for Young Leaders (Disaster Reduction course) organized by Japan International Cooperation Agency (JICA). He is a member of state level technical advisory committee for urban local bodies of Uttar Pradesh. He is also a member of Scientific Committee, Advances in Materials and Pavement Performance Prediction (AM3P) and European Asphalt Technology Association (EATA) conferences. He is also a reviewer for many international journals such as International Journal of Pavement Engineering (T&F); Journal of Materials in Civil Engineering (ASCE); Construction and Building Materials (Elsevier); Road Materials and Pavement Design (T&F); International Journal of Pavement Research and Technology (Springer); Mechanics of Time Dependent Materials (Springer) etc.

### COURSE PLAN :

- 1. Soil:** Introduction to soil as a highway material; Classification of soils; Consistency Limits; Soil compaction and role of moisture; Mechanical properties of soil (Shear strength, Unconfined compressive strength, Resilient modulus, California bearing ratio, Modulus of subgrade reaction etc.); Introduction to expansive soils, relevant tests, and soil stabilization techniques.
- 2. Aggregates:** Aggregate origin, types, production, and quarrying operation; Classification of aggregates; Aggregate gradation and gradation parameters; Theories of aggregate blending; Minerology of aggregates and its importance; Aggregate shape and texture: quantification and importance; Aggregate strength properties, and relevant tests.
- 3. Bitumen, Modified bitumen, Bitumen emulsion and Cutback bitumen:** Bitumen as a binding agent; Production of bitumen; Physical and rheological properties of bitumen; Introduction to viscoelasticity; Chemistry of bitumen; Ageing of bitumen; Grading of bitumen, and relevant tests: Penetration grade, Viscosity grade, Performance grade; Bitumen modification: Need, Types and Importance; Introduction of bitumen emulsion: Theory of emulsification, Uses, Grading of emulsions, and Relevant tests; Introduction to cutback bitumen: Types, Uses, and relevant tests.
- 4. Bituminous Mixtures:** Production of bituminous mixtures: Laboratory and Plant; Role of bituminous mixture and desirable properties; Volumetrics of bituminous mixture; Mix design of bituminous mixture: Marshall and Superpave methods; Mechanical tests and characterization of bituminous mixtures; Introduction to performance based mix design concepts; Mix design of cold bituminous mixtures; Mix design of hot recycled mixtures
- 5. Cement:** Production of cement; Theory of hydration and importance of different hydration products; Physical and chemical properties of cement; Types of cement; Pozzolanic and geopolymer materials as alternate cement.
- 6. Concrete Mix Design:** Concrete proportioning and importance of various constituents; Introduction and mix design of pavement quality concrete, Dry lean concrete and Pervious concrete
- 7. Alternative Pavement Materials:** State of the art on various alternative materials for construction of flexible and rigid pavements.