

MATERIALS FOR PAVEMENTS

(Professional Elective-2)

	I Semester		
Course Code: 19CE2154	L	P	C
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Prerequisites : Transportation Engineering

Course Outcomes :

At the end of the course, the student will be able to:

CO1 Explain about various aspects of Fine and coarse aggregates.

CO2 Illustrate various tests on bitumen and Cutbacks.

CO3 Explain about emulsions and modified binders.

CO4 Demonstrate experimental procedure of bitumen mixes.

CO5 Illustrate the role of geo-synthetics in pavements

UNIT-I:

(10 Lectures)

AGGREGATES

Fine Aggregate: Sources, Classification, Tests

Coarse Aggregate: Origin-Sources, classification, requirements, Desirable, chemical and physical properties and tests on road aggregates-Toughness and Abrasion Resistance, Durability and Soundness, Particle Shape and Texture, Various ways of measuring particle shape - Concepts of size and gradation – design gradation, maximum aggregate size, Specific Gravity.

Learning outcomes:

1. Discuss about Source, classification and tests of Coarse Aggregate (L2)

2. Discuss the concepts of size and gradation (L2)
3. Illustrate Properties of Fine Aggregates (L4)

UNIT-II:**(10 Lectures)****BITUMEN, TAR AND CUTBACKS**

Bitumen, Tar: Origin, Terminology, Bitumen from Petroleum Crude - preparation, properties and chemical constitution of bituminous road binders; Study of Bitumen-Purity, Safety and Consistency-Penetration, Softening Point, Ductility, Fraass Breaking Point, Viscosity, Measurement of Viscosity, Specific Gravity, Aging of bitumen, Penetration Grading, Viscosity Grading, Performance Grading.

Different Versions of IRC: 73, Super pave Specifications-SP1

Cutbacks-Definition, Types, Application of Cutbacks.

Learning outcomes:

1. Discuss the uses of various tests on bitumen (L2)
2. Discuss about Super pave and cutbacks (L2)
3. Illustrate the Origin, Preparation and tests of bitumen (L4)

UNIT-III:**(10 Lectures)****BITUMINOUS EMULSIONS AND MODIFIED BINDERS**

Emulsions- Definition, Applications, Emulsifiers, Stability and adhesion of emulsion, Classification, Breaking and Curing of Emulsions, Selection of grade of emulsion, Advantages, Testing of emulsions, Specifications of Cationic emulsion.

MODIFIED BINDERS-Advantages, Requirements, Specification-PMB, NRMB, CRMB, Criteria for selection, Issues, Elastic Recovery Test, Separation Test,

Learning outcomes:

1. Explain about the advantages, requirements of modified binders (L2)
2. Illustrate classification, curing and selection of emulsions (L4)
3. Compare the specification of modified binders (L4)

UNIT-IV: (10 Lectures)

BITUMINOUS MIXES- Common failures of bitumen pavement, Types of mixes, Objective of hot mix design, Requirements, Volumetric, Parameters measured, parameters Computed, Volumetric Analysis, Primary Objective of Mix Design, Effect of aggregate size and gradation, Blending of Aggregate, Design Methods of Bitumen Mixes, Marshall Method of Mix Design, Testing Samples, Mixing and Compaction Temperatures, Volumetric Analysis, Selection of Optimum binder content, Advantages and Limitations of Marshall Method;

Learning outcomes:

1. Discuss common failures of bitumen pavement(L2)
2. Discuss about the advantages and limitations of Marshall Method (L2)
3. Design bituminous mix using Marshall Method (L5)

UNIT-V: (10 Lectures)

MIX DESIGN & APPLICATION OF GEO-SYNTHETICS IN PAVEMENTS

Superpave Mix Design as per MS2, RAP Mix Design

Types, Advantages, Limitations of Geo-Synthetics

Learning outcomes:

1. Discuss about types, advantages and limitations of Geo-Synthetics (L2)
2. Compare various types of Geo-synthetics (L4)
3. Design Superpave and RAP (L5)

Text Books:

1. Khanna,S.,K., & Justo,C.,E.,G., *Highway Engineering*, 7th Edition, Nemchand & Bros., 2000.
2. V.N. Vazirani and S.P.Chandra, *Transportation Engineering*, Vol. I, 4th Edition, Khanna Publications, 1994.

References:

1. Bindra,S.,P., *Highway Engineering*, 4th Edition, Dhanpat Rai & Sons, 1981
2. Khanna, S., K., C.E.G.Justo & Veera Raghavan,A., *Highway Materials and Pavement Testing*, 5th Edition, Nemchand & Bros. 2009
3. NPTEL Videos
4. Indian Road Congress, Ministry of Road Transport and Highways, and Special Publications.
5. IRC: 37-2001, IRC: 94, IRC: 14-2004 IRC:17, IRC:23, IRC:48