

GUJARAT TECHNOLOGICAL UNIVERSITY

Diploma in Transportation Engineering

Semester: 3

Subject Code

Subject Name HIGHWAY MATERIAL AND TESTING

Sr. No.	Course content
1.	SOIL SUBGRADE AND ITS TESTING : 1.1 Significance of Sub-grade Soil 1.2 Characteristics of Soil 1.3 Desirable Properties 1.4 Index Properties of Soil 1.5 Soil Classification based on grain Size 1.6 Soil Classification System 1.7 Sub-grade Soil Strength 1.8 Evaluation of soil Strength 1.8.1 Bearing Test 1.8.2 Triaxial Compression Test 1.8.3 Unconfined Compression Test 1.8.4 California Bearing Ratio Test
2.	ROAD AGGRAGATE AND ITS TESTING : 2.1 Introduction 2.2 Classification of Rocks 2.3 Sources of Stone 2.4 Rock forming Minerals 2.5 Texture or Structure of a Rock 2.6 Fracture of a Rock 2.7 Uses of Stone 2.8 Natural bed of Stone 2.9 Stone Quarrying 2.9.1 Machines for quarrying 2.10 Stone Blasting 2.10.1 Tools for Blasting 2.10.2 Materials for Blasting 2.10.3 Process for Blasting 2.10.4 Precautions in Blasting 2.11 Desirable Properties of Road Aggregate 2.12 Tests for Road Aggregate 2.12.1 Crushing Test 2.12.2 Abrasion Test 2.12.3 Impact Test 2.12.4 Soundness Test 2.12.5 Shape Test 2.12.6 Specific Gravity and Water Absorption Test 2.12.7 Bitumen Adhesion Test

3.	BITUMINOUS MATERIAL AND ITS TESTING : 3.1 Introduction 3.2 Types of Bituminous Materials 3.2.1 Bitumen 3.2.2 Cutback Bitumen 3.2.3 Bituminous Emulsion 3.2.4 Tar 3.3 Tests on Bitumen 3.3.1 Penetration Test 3.3.2 Ductility Test 3.3.3 Viscosity Test 3.3.4 Float Test 3.3.5 Specific Gravity Test 3.3.6 Softening Point Test 3.3.7 Flash and Fire Point Test 3.3.8 Solubility Test 3.3.9 Spot Test 3.3.10 Loss on heating Test 3.3.11 Water Content Test
4.	CEMENT AND ITS TESTING : 4.1 Definition 4.2 Properties of Cement 4.3 Composition of Ordinary Cement 4.4 Functions of Cement ingredients 4.5 Harmful Constituents of Cement 4.6 Setting Action of Cement 4.7 Site for Cement Factory 4.8 Manufacturing of Ordinary Portland Cement 4.9 Packing of Cement 4.10 Storage of Cement 4.11 Use of Cement 4.12 Varieties of Cement 4.13 Field Tests for Cement 4.14 Laboratory Tests for Cement 4.14.1 Chemical Composition Test 4.14.2 Fineness Test 4.14.3 Compressive Strength 4.14.4 Tensile Strength 4.14.5 Consistency Test 4.14.6 Setting Time Test 4.14.7 Soundness Test
5.	CEMENT CONCRETE AND ITS TESTING : 5.1 Definition 5.2 Properties of Cement Concrete 5.3 Materials used in R.C.C. Work 5.4 Corrosion of Steel in Concrete 5.4.1 Theory of Corrosion 5.4.2 Causes of Corrosion 5.4.3 Effect of Corrosion 5.4.4 Prevention of Corrosion

	5.5 Water Cement Ratio 5.6 Workability 5.7 Slump Test 5.8 Mixing the Material of Concrete 5.8.1 Hand Mixing 5.8.2 Machine Mixing 5.9 Transporting and Placing of Concrete 5.10 Consolidation of Concrete 5.10.1 Hand Consolidation 5.10.2 Vibrators 5.10.2.1 Internal or immersion Vibrators 5.10.2.2 Surface Vibrators 5.10.2.3 Form or Shutter Vibrators 5.10.2.4 Table Vibrators 5.11 Curing of Concrete 5.11.1 Meaning of Curing 5.11.2 Purposes of Curing 5.11.3 Period of Curing 5.11.4 Methods of Curing 5.12 Types of Concrete 5.12.1 Water Proofing Cement Concrete 5.12.2 Colored Concrete 5.12.3 Light Weight Concrete 5.12.4 No fines Concrete 5.13 Joints in the Concrete 5.13.1 Construction Joints 5.13.2 Expansion and Contraction Joints 5.14 Form Work of Concrete 5.14.1 Precautions in form work 5.15 Pre-cast Concrete 5.15.1 Advantages and Disadvantages of Pre-cast Concrete 5.16 Quality Control of Concrete
6.	6 BITUMINOUS PAVING MIXES: 6.1 Requirement of Bituminous Mixes 6.2 Desirable Properties of Bituminous Mix 6.3 Design of Bituminous Mixes 6.3.1 Marshal method of Bituminous mix Design 6.3.2 Modified Hubbard method of Bituminous mix Design 6.3.3 Hveem method of Bituminous mix Design

Term Work :

Term Work based on the following Tests

1. Test on Soil Subgrade: California Bearing Ratio Test
2. Tests for Road Aggregate
 - Abrasion Test
 - Impact Test
 - Shape Test

3. Tests for Cement
 - Fineness Test
 - Consistency Test
 - Setting Time Test
 - Soundness Test
4. Tests on Bitumen
 - Penetration Test
 - Softening Point Test
 - Flash and Fire Point Test
5. Tests on Concrete: Slump Test
6. Marshal Method of Bituminous Mix Design

REFERENCE BOOKS :

1. Highway Engineering by S.K.Khanna and C.E.G.Justo, Nem chand Bros. Roorkee.
2. Highway Engineering by S.P.Bindra Dhanpat Rai & Sons, Delhi
3. Principles and Practice of Highway Engineering by S.C.Sharma and C.C.Sharma , Asia publishing House ,Delhi
4. Highway Engineering By L.R.Kadiyali
5. Highway Engineering & Airports By K.L.Bhagat & S.B.Bhagat ,S.Chand & Co., Delhi
6. Highway Engineering by S.C. Rangwala
7. Transportation Engineering Vol. I & II By Vazirani & Chandola