# GUJARAT TECHNOLOGICAL UNIVERSITY

**Master of Engineering- Transportation Engineering**
**Subject Code 3721321**
**Semester – II**
**Subject Name: Advances in Highway Material and Construction**

**Type of course:** Program Elective - IV

**Prerequisite:** NIL

**Rationale:** The Indian Government has set ambitious plans for upgrading of the National Highways in a phased manner. It is required to upgrade the knowledge of current practices in highway/pavement construction. The objective of the course is to introduce the basic concepts of methods of pavement structure. It includes the study of various types of advance material used in pavement construction work. It is necessary to reduce the cost and proper. The knowledge of construction techniques of various types of roads is covered. Advance Machinery used in construction work also introduced to make more familiar of road construction techniques along with advance materials used.

**Teaching and Examination Scheme:**

| Teaching Scheme | | | Credits | Examination Marks | | | | Total Marks |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory Marks | | Practical Marks | | |
| L | T | P | C | ESE (E) | PA (M) | ESE (V) | PA (I) | |
| 3 | 0 | 2 | 4 | 70 | 30 | 30 | 20 | 150 |

**Content:**

| Sr. No. | Content | Total Hrs |
|---|---|---|
| 1 | High Performance Highway Construction Materials: Introduction, Use of waste materials: Fly ash, Slag, Recyclable waste, Other waste materials. Modified bituminous materials: PMB, EMB, NRMB, CRMB, IS requirements and testing procedures. Concrete: introduction, advantages, IS requirements, mineral admixtures, applications, Advances in pavement material, super pave, micro surfacing etc. | 10 |
| 2 | Highway Construction : Principles of road construction, preparation of embankment, : Formation cutting in ordinary soil and hard rock Ground improvements, construction procedure for GSB, DBM, SDBC etc. layers of roads | 5 |
| 3 | Bituminous pavement Construction : prime , tack, seal coats, bituminous-bituminous penetration macadam, surface dressing, premix carpet and bituminous concrete Recycling of bituminous pavement materials Construction of earthen, gravel and water bound macadam, wet mix macadam roads | 10 |
| 4 | Cement Concrete Pavement Construction : procedure for construction of base and sub base, tools and plants and required, Types of construction joints, Joints filler and sealer, reinforced, Pre-stressed, Vacuum dewatered pavement | 10 |
| 5 | Road Construction Machineries, Role of labor v/s machinery in road construction, Earthwork machinery ,Rock excavation machinery ,Transporting Equipment, Compaction Equipment , Bituminous concrete road equipment , Cement Concrete road making Equipment ,Equipment Usage charges | 10 |
| | **TOTAL** | **45 Hr.** |

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**Suggested Specification table with Marks (Theory): (For ME only)**

**Distribution of marks weightage for cognitive level**

| Bloom's Taxonomy for Cognitive Domain | Marks Weightage (%) |
|---|---|
| Recall | 10 |
| Comprehension | 20 |
| Application | 30 |
| Analysis | 20 |
| Evaluate | 10 |
| Create | 10 |

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

**Reference Books:**


1. Kerbs and Walkes, "Highway Materials", McGraw Hill Book
2. Atkins & Harold, Highway Materials,Soils and concretes, Prentice hall Pearson
3. Walker and Martin. Asphalt Pavement Engg.
4. Kerbs and Walker, Highway Materials
5. HMSO, Soil Mechanics for Road Engineers
6. HMSO, Bituminous Materials for Engineers
7. MOST Standards for Highway constructions
8. Atkins Harold N., Highway Materials, Soils, and Concrete, Prentice Hall, 1996.
9. Kadiyali L.R.and Lal, N. B., Principles & Practice of Highway Engineering, Khanna Publishers,Delhi.
10. Various IRC codes for construction of Bituminous & Concrete Roads
11. Partho Chakraborty and Animesh Das, Principles of Transportation Engineering, PHI


**Course Outcomes: At the end of the course, Student will be able**

| Sr. No. | CO statement | Marks % weightage |
|---|---|---|
| CO-1 | To create awareness about the advance material available for highway construction | 20% |
| CO-2 | To Justify the use of the advance material with the advantages | 30% |
| CO-3 | To select various methods of construction of different types of roads and their components, specifications and tests thereof. | 10% |
| CO-4 | To analyse the need of construction equipment and its use | 30% |
| CO-5 | To know and identify the use of Advance materials and Describe the procedure of advanced techniques in highway constructions | 10% |

**List of Experiments:**

1. Various tests on Soils.
2. Tests on aggregates.
3. Tests on bitumen.
4. Tests on bituminous mix

**List of Tutorials:**

1. Visit to Hot mix plant where modified bituminous materials or mixes are used.
2. Problems on bituminous mix.
3. Visit to road construction site where Fiber Reinforced Concrete or High Performance Concrete is used.