



# GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Master of Engineering

Level: PG

Branch: Civil Engineering (Transportation Engineering)

Subject Code: ME02069101

Subject Name: Advanced Highway Construction Technology

|                         |                              |
|-------------------------|------------------------------|
| w. e. f. Academic Year: | 2024-25                      |
| Semester:               | 2                            |
| Category of the Course: | Professional Elective Course |

|                      |  |
|----------------------|--|
| <b>Prerequisite:</b> | Transportation Engineering.  |
| <b>Rationale:</b>    | Highway construction technology plays a vital role in modern infrastructure development, offering numerous benefits in terms of economic, safety, social and environmental. Advanced pavement technology includes design & construction concepts of pavement recycling, warm bituminous mix, cement grouted bituminous mix, white topping practices, functional treatment to improve the riding quality of pavement, plastic aided bituminous mix. Knowledge of advanced technology in highway construction is essential for structural integrity and durability of highway, longevity of highway infrastructure, improved infrastructure quality and better decision-making and policy development. |

## Program Outcomes

| No | Program Outcomes  |
|----|---|
| 01 | Engage in critical thinking and research to develop solutions to multifold real-world problems.   |
| 02 | Communicate effectively with the engineering community at large level on complex design tasks & write and present technical reports.                    |
| 03 | Demonstrate a high level of professionalism in handling multidisciplinary and complex engineering problems.   |
| 04 | Plan, assess, create, integrate, carry out, and oversee complex engineering projects in a sustainable local and global context.                         |
| 05 | Address societal issues by offering technologically advanced, reasonably priced solutions while upholding high standards of ethics and professionalism. |

## Course Outcome:

After Completion of the Course, Student will be able to:

| No | Course Outcomes  | RBT Level |
|----|--|-----------|
| 01 | Know the advance construction procedure of flexible pavement.                        | R         |
| 02 | Appreciate the recent trends in White topping and SMA.                               | N         |
| 03 | Understand the different methods and technologies used to recycle asphalt pavements. | A         |
| 04 | Evaluate the necessity of required maintenance and suggest suitable treatment.       | E         |
| 05 | Learn new techniques in road construction.   | U         |

\*Revised Bloom's Taxonomy (RBT)



# GUJARAT TECHNOLOGICAL UNIVERSITY

**Program Name: Master of Engineering**

**Level: PG**

**Branch: Civil Engineering (Transportation Engineering)**

**Subject Code: ME02069101**

**Subject Name: Advanced Highway Construction Technology**

**Teaching and Examination Scheme:**

| Teaching Scheme<br>(in Hours) |   |    | Total<br>Credits<br>L+T+ (PR/2) | Assessment Pattern and Marks |                |           |                      | Total<br>Marks |
|-------------------------------|---|----|---------------------------------|------------------------------|----------------|-----------|----------------------|----------------|
| L                             | T | PR |                                 | C                            | Theory         |           | Tutorial / Practical |                |
|                               |   |    | ESE<br>(E)                      |                              | PA / CA<br>(M) | PA/CA (I) | ESE (V)              |                |
| 3                             | 0 | 2  | 4                               | 70                           | 30             | 20        | 30                   | 150            |

**Course Content:**

| Unit No.     | Content  | No. of Hours | % of Weightage (%) |
|--------------|--|--------------|--------------------|
| 1.           | <b>Warm Mix Asphalt:</b> Introduction, Overview of Warm Mix Asphalt Technology, Benefits, Choice of an Appropriate Warm Mix Asphalt Technology, Design of Warm Mix Asphalt Mixes, Production, Construction Operation, Quality Assurance.<br><b>Cement Grouted Bituminous Macadam:</b> India and International practice, Materials, Mix design, Pavement design, CGBM production, CGBM construction.  | 10           | 25                 |
| 2.           | <b>White Topping:</b> Benefit, Types, Materials, Concrete Mix, Pre overlay repair, evaluation, Thickness design, Construction steps, Joints.<br><b>Stone Matrix Asphalt:</b> Scope, Material, stabilizer additives, Mix Design, SMA production, Placement and compaction, Quality control.   | 9            | 25                 |
| 3.           | <b>Recycling of Pavement:</b> Recycling of pavement, reclaiming and reprocessing, different aspect of recycling, investigation of existing pavement, Design consideration, Cold recycling, Hot recycling, FDR, Quality control.  | 9            | 20                 |
| 4.           | <b>Micro surfacing, slurry seal and Mastic Asphalt:</b> Scope, application and limitation, material, Mix design, Construction, Quality control<br><b>Waste Plastic in Hot Bituminous Mix:</b> Scope, advantage and limitation, Materials, Construction and Quality control.  | 9            | 15                 |
| 5.           | <b>New Technologies:</b> Recycle aggregate pavement as per IRC:120 (RAP). Cold in place (CIP), Hot in place (HIP), plant mix technology, Methodology of construction, Cold mix technology as per IRC SP-100, White topping – Conventional, Ultra-thin white topping as per IRC SP-76, Stone matrix asphalt as per IRC SP-79, Warm mix asphalt as per IRC SP 101, Micro surfacing ,slurry seal as per IRC SP-81. Aggregate other than Natural resources-steel slag, copper slag, Iron slag. | 8            | 15                 |
| <b>Total</b> |  | <b>45</b>    | <b>100</b>         |



# GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Master of Engineering

Level: PG

Branch: Civil Engineering (Transportation Engineering)

Subject Code: ME02069101

Subject Name: Advanced Highway Construction Technology

## Suggested Specification Table with Marks (Theory):

| Distribution of Theory Marks (in %) |         |         |         |         |         |
|-------------------------------------|---------|---------|---------|---------|---------|
| R Level                             | U Level | A Level | N Level | E Level | C Level |
| 20                                  | 20      | 30      | 10      | 20      | -       |

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

## References/Suggested Learning Resources:

### (a) Books:

1. IRC: SP: 100-2014 Use of Cold Mix Techno. in Const. & Maint. of Road using Emulsion
2. IRC: SP: 101-2019 Guidelines for Warm Mix Asphalt
3. IRC: SP: 125-2019 Guidelines for cement Grouted Bituminous Mix Surfacing for Urban Roads
4. IRC: SP: 76-2015 Guidelines for Conventional and Thin White Topping
5. IRC: SP: 79-2008 Tentative Guideline for Stone Matrix Asphalt
6. IRC: SP: 81-2008 Tentative Specifications For Slurry Seal And Micro surfacing
7. IRC: SP: 98-2013 Guidelines for the Use of Waste plastic in Hot Bitumen Mix (Dry Process) in Wearing Course
8. IRC: 120-2015 Recommended Practice for Recycling of Bituminous Pavements
9. IS: 383-2016 Coarse and Fine Aggregate for Concrete - Specification
10. Specifications for Road and Bridge Works By MoRT&H | MoRT&H
11. Y. H Huang. *Pavement analysis and Design*. Prentice-Hall, Englewood Cliffs, New Jersey, 1993.
12. Yoder E. J. and Witczak M. W., *Principles of Pavement Design*, John Wiley and Sons, New York, 1975
13. Kandhal, P.S., *Bituminous Road Construction in India*, PHI Learning Pvt. Ltd, 2016, First Edition.
14. *Specifications for Road and Bridge Works*, Ministry of Road Transport and Highways, Indian Roads Congress, New Delhi, India, 2013, Fifth Edition.

### (b) Open resources on website:

1. <https://www.morth.nic.in>
2. <https://pavementinteractive.org/reference-desk/construction/site-preparation/subgrade-preparation-for-new-pavements/>
3. [https://www.virginiadot.org/vtrc/main/online\\_reports/pdf/15-r6.pdf](https://www.virginiadot.org/vtrc/main/online_reports/pdf/15-r6.pdf)

### (c) Suggested Course Practical List:

1. Problem on case study of design of Flexible pavement for NH/SH using IIT PAVE for granular subbase and base course.
2. Design of Rigid pavement for fatigue damage as per IRC:58 using IITRIGID.



# GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Master of Engineering

Level: PG

Branch: Civil Engineering (Transportation Engineering)

Subject Code: ME02069101

Subject Name: Advanced Highway Construction Technology

---

## (d) Suggested Project List:

Students will have to prepare a detailed report on their visit to a road construction site. Students will also incorporate case study of at least 3 road projects under construction in state/country with technical details and construction procedure adopted for advancement or better quality of pavement.

\* \* \* \* \*