

Seat No: \_\_\_\_\_

Enrolment No. \_\_\_\_\_

## **GUJARAT TECHNOLOGICAL UNIVERSITY**

**M.E. Sem – I Examination January 2010**

**Subject code: 711903**

**Subject Name: Highway Materials and Testing**

**Date: 25 / 01 / 2010**

**Time: 12.00 – 2.30 pm**

**Total Marks: 60**

**Instructions:**

- 1. Attempt all questions.**
- 2. Make suitable assumptions wherever necessary.**
- 3. Figures to the right indicate full marks.**

- Q.1 (a)** Define the following: **06**  
Pitches, slurry seal, tar concrete hot laid, mulch treatment, refined tar, fog seal.
- (b)** Explain the bituminous emulsion with classification. **06**
- Q.2 (a)** Mention any two grades of bitumen, in general use on road network in Gujarat State and say where and why each grade is suitable. **06**
- (b)** State the importance of aggregate grading in road construction. Discuss Rothfutch's Method of mixing the aggregate to obtain the specified grading. **06**
- OR
- (b)** Explain the concept of viscosity of bituminous material. Also state the standards with application of viscosity to different types of primer porosity. **06**
- Q.3 (a)** Explain briefly the constituents of bitumen and the rheological process. **06**
- (b)** Explain the causes of stripping of aggregates from bituminous road construction. State the mechanism of anti-stripping agent on bituminous road construction. **06**
- OR
- Q.3 (a)** Mention the names of three routine laboratory tests for aggregates and bitumen and also discuss the significance of each. **06**
- (b)** "Even though tar is not that suitable as compared to asphalt, yet it can be used for specific purposes". Explain the statement. **06**
- Q.4 (a)** What is the basic purpose of modifier and state the type of additives for bitumen modification with optimum dose level? **06**
- (b)** Explain in detail the Marshall Method of bituminous mix design. **06**
- OR
- Q.4 (a)** State the sources of crumb rubber, types and requirements of it. **06**
- (b)** Explain the terms percent density, void in mineral aggregate (VMA) and their importance in mix design. **06**

**Q.5 (a)** State the procedure of steel-fiber reinforced concrete design with standards. **06**

**(b)** A specimen of asphaltic concrete has a height of 6.20 cm and a diameter of 10.16 cm. The weight of specimen (uncoated) in air is 1174.7 gms and in water is 668.4 gms. When coated with paraffin wax, its weight in air is 1220.9 gms and its weight when immersed in water is 664.4 gms. The specific gravity of paraffin wax is 0.90. The analysis of the specimen yielded the following. **06**

| Material                      | Specific gravity |          | Mix Composition<br>(% by weight of total mix) | Aggregate Composition<br>(% by weight of total aggregates) |
|-------------------------------|------------------|----------|-----------------------------------------------|------------------------------------------------------------|
|                               | Bulk             | Apparent |                                               |                                                            |
| 1. Asphaltic cement (Bitumen) | 1.02             | 1.02     | 6.0                                           | -----                                                      |
| 2. Coarse Aggregates          | 2.58             | 2.70     | 52.0                                          | 55.3                                                       |
| 3. Fine Aggregates            | 2.72             | 2.80     | 34.6                                          | 36.8                                                       |
| 4. Mineral Filler             | 2.70             | 2.70     | 7.4                                           | 7.9                                                        |
|                               |                  |          | 100.0                                         | 100.0                                                      |

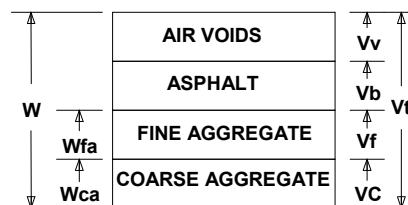
Calculate :

1. Bulk density of specimen by uncoated specimen procedure and immersion test.
2. Bulk density of specimen from specimen dimensions.
3. Bulk density of specimen by paraffin wax coated sample procedure.
4. Average specific gravity of the aggregates.
5. Maximum theoretical density.
6. Bulk density as percent of maximum density.

OR

**Q.5 (a)** Write a short note on Road Note No. 4. **06**

**(b)** Establish a relationship, using given block diagram, between percentage air voids, V.M.A, bulk specific gravity and theoretical specific gravity in a compacted bituminous specimen. **06**



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