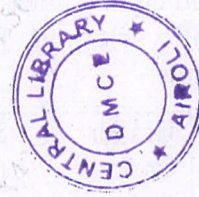06.06.2025

BE(CIVIL) / Sem-VII / R-191 'C' scheme / PMCM

Time: (3 Hours)

[Total Marks : 80

N.B:
1. Question No **ONE** is **Compulsory**.
2. Attempt any **Three** from remaining five **questions**
3. Assume suitable data wherever required.
4. Figures to the right indicate full marks.

1. Attempt any **four** of the following [20]

a) State the significance of LL and PI values in characterisation of soil properties that are used for road construction. 05

b) What is the difference between continuously reinforced concrete pavement (CRCP) and jointed reinforced concrete pavement (JRCP)? 05

c) What are the key differences between QC and QA activities during pavement construction? 05

d) A bituminous mix requires a gradation to satisfy the following limits for a particular sieve size: 05

Target passing: 60%

Two aggregates (A and B) are available with the following % passing for that sieve:

Aggregate % Passing (Sieve X)

A   80%

B   40%

Determine the **proportion of aggregates A and B** needed to achieve the target gradation of 60% passing.

e) Write short note on: basic principles of mix design of cement concrete and bituminous mixes 05

2. a) Discuss the roles and responsibilities of contractors and engineers in implementing QA/QC for pavement works. 10

b) What are the typical **QC tests** conducted during the construction of: 10

- a) Flexible pavements
- b) Rigid pavements?

3. a) Explain the step-by-step procedure for the construction of cement concrete pavements. 10

b) Discuss the suitability of soil as subgrade materials with reference to stability volume changes, drainage and frost action at subgrade materials A-1-A, A-2-7, A-3, A-7-2, A-5-11, A6-4 10

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4. a) A road construction laboratory is designing a bituminous mix using the **Marshall Stability Method**. The following test results were obtained for various binder contents: 　20

Binder Content (%)	Stability (kN)	Flow (mm)	Bulk Density (g/cm³)	Theoretical Maximum Specific Gravity (Gmm)
4.0	8.5	2.2	2.340	2.480
4.5	9.0	2.4	2.355	2.480
5.0	9.5	2.6	2.365	2.480
5.5	9.2	2.8	2.360	2.480
6.0	8.6	3.0	2.350	2.480

Analyze the data and calculate the following volumetric parameters for each binder content:
a) Air Voids (Va)
b) Voids in Mineral Aggregate (VMA)
c) Voids Filled with Bitumen (VFB)
Plot graphs (manually or using software) of the following against binder content:
  o Stability
  o Flow
  o Air Voids (Va)
  o VMA
  o VFB
Determine the Optimum Binder Content (OBC) by satisfying the Marshall criteria and balancing volumetric requirements.
Justify your selection of OBC with reference to performance parameters and design requirements.

5. a) Define flakiness index and elongation index. How do they affect the performance of bituminous pavements? 　10

   b) The flakiness index and elongation index of a coarse aggregate sample are found to be: 　10

   * Flakiness Index = 24%
   * Elongation Index = 18%

   Check whether the aggregate blend **meets the shape requirement** for a dense-graded bituminous mix as per MoRTH or IRC specifications (.

6. a) Explain how grading of aggregates will affect the performance of pavement 　10

   b) What is the significance of the Unconfined Compressive Strength (UCS) test in soil stabilization? 　10

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