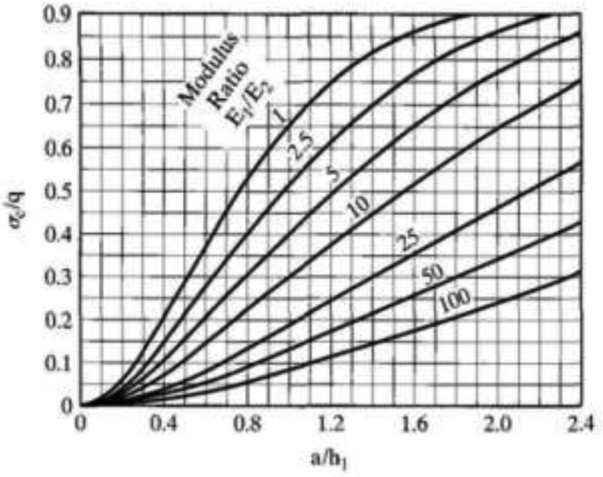
Ref. No.: Ex/PG/CIV/PE/T/113D/2025

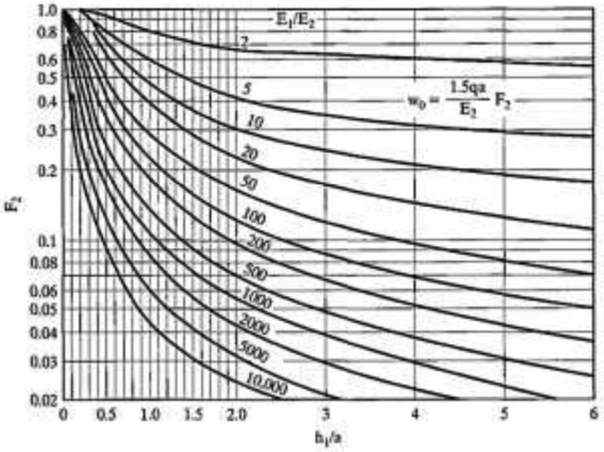
M.E. CIVIL ENGINEERING FIRST YEAR FIRST SEMESTER EXAM 2025
HIGHWAY GEOTECHNICS

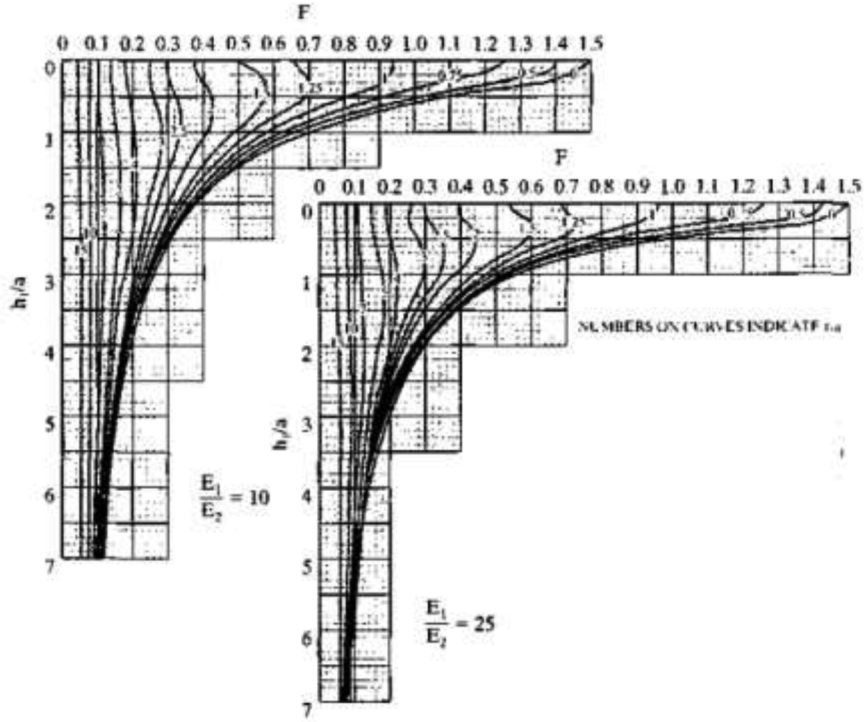
Time: 3 Hours **Full Marks: 100**
[60 Marks for this part]

Part I
Use Separate Answer scripts for each Part
Answer ALL Questions
Answer brief & to the point. Assume standard value for any parameter, if required

1. An equivalent circular load having radius 150 mm and uniform pressure 500 kPa is applied on a two-layer pavement system. The sub-grade has elastic modulus 35 MPa and can support a maximum vertical stress of 50 kPa. If the pavement layer has elastic modulus 350 MPa, what is the required thickness of the full-depth pavement? Also determine the surface, interface and intermediate critical deflections for the said pavement structure. Use standard charts as follows – 5+4+4+2







2. In context of AASHO method of flexible pavement design answer the following – 3+2+2+3+5
   a. Write full forms of AASHO, PSI and SN
   b. Explain what is ΔPSI
   c. Explain how serviceability index is obtained
   d. State the criteria terminal PSI values as normally adopted for design of different roads
   e. Explain how SN value is linked with layer characteristics as well as traffic characteristics

3. Explain the following in context of multi-layer pavement stability as per IRC:37-2018 4+4+2
   a. Rutting criteria
   b. Fatigue cracking criteria for granular sub-base
   c. Reliability effect

4. Answer the following in context with flexible pavement failures
   a. Name five major exposure conditions that lead to pavement distress and explain any one of them. 5+2
   b. Name the two major types of pavement failure due to distress and name six sub-types of each. Explain in detail one sub-type of each major type 1+6+6

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M.E. Civil Engineering

[1st Year; 1st Semester Examination - 2025]

Highway Geotechnics

Total Time: Three Hours | Full Marks 100 (Part I: 50 + Part II: 50)

Use a separate Answer-Script for each part

Part II (50 Marks)

(Codes are NOT Allowed)

Answer all in brief and to-the-point (Assume any relevant data if not provided)

1 Why modification of highway subgrades is required? Mention different methods of modifications. (5)

2 Discuss 'Cement Stabilization' and 'Lime Stabilization' based on their applicability. (5)

3 Explain a possible compaction process for a pavement system having a clayey subgrade with high moisture content which will be topped with 450 mm thick coarse sand layer. (5)

4 Explain (with schematic diagram) the construction process for a mechanically stabilized earth wall with geotextiles as a 'wrapped up' technique. (5)

5 What is 'internal stability'? How can it be generated and mention its advantages? (5)

6 A typical vertical MSE wall (with metallic strips and concrete facia wall) for a highway flyover approach way is mentioned hereunder. (25)

- Height: 9 m;
- Width of the metal strips = 100 mm;
- Thickness of the metal strips = 5 mm;
- Yield strength of the metal strip = 240 MPa;
- Internal friction angle of the sandy back fill soil = 36°,
- Unit weight of the back fill soil = 17.5 kN/m^3;
- Interfacial friction angle between metal strips and backfill soil = 25°;
- Horizontal = Vertical spacing of the strips = 1 m.

Consider No-Surcharge and horizontal back fill condition and the FOS on –

- Tie-break up as 1.67,
- Soil friction as 1.5,
- Sliding as 1.5,
- Overturning as 2.0,

Design and draw a proper schematic diagram for the "OPTIMUM" reinforcing system with the stability analysis.

END