

**B.E. CIVIL ENGINEERING FOURTH YEAR FIRST SEMESTER EXAM 2024  
ADVANCED PAVEMENT ENGINEERING**

Time: 3 Hours

Full Marks: 100  
[50 Marks for each 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**

**Group: I**

1. Explain the following in terms of multi-layer pavement stability following IRC 'codal provision -- 4+4+2
  - a. Rutting criteria
  - b. Fatigue cracking criteria for granular sub-base
  - c. Reliability effect
  
2. Explain the terms involved in the following equations and mention their application 8
  - a.  $N_R = 4.1656 \times 10^{-08} [1/\epsilon_v]^{4.5337}$
  - b.  $N_R = 1.4100 \times 10^{-08} [1/\epsilon_v]^{4.5337}$
  - c.  $N_F = 1.6064 * C * 10^{-04} [1/\epsilon_t]^{3.89} * [1/M_{Rm}]^{0.854}$
  - d.  $N_F = 0.5161 * C * 10^{-04} [1/\epsilon_t]^{3.89} * [1/M_{Rm}]^{0.854}$
  
3. For a National Highway with 190mm thick Bituminous Pavement over 250mm thick Granular Base and 230mm thick Sub-base, the stress strain analysis of layers evolved following result. Considering resilient modulus of granular layers as 200 MPa, find the critical rutting and fatigue life. Relevant equations from Qn (2) may be used.  
Horizontal tensile strain at 190mm and 670mm are  $0.1458 \times 10^{-03}$  and  $0.9590 \times 10^{-04}$  respectively AND vertical compressive strain at 190mm and 670mm are  $0.1245 \times 10^{-03}$  and  $0.2443 \times 10^{-03}$  respectively. Per cent volume of air void in the mix used in the bottom bituminous layer is 3% and Per cent volume of effective bitumen in the mix used in the bottom bituminous is 11.5%. Resilient modulus of the bituminous mix is 2000 MPa. 12

**Group: II**

4. Draw neatly schematic structures of flexible and rigid pavement and explain in detail how the subsurface pore water influence in failure mechanism of each 4+3+3
5. Briefly Explain the following pavement distresses 4+3+3
  - a. Potholes and Seepage
  - b. Pumping
  - c. Bleeding

[ Turn over

**B.E. CIVIL ENGINEERING EXAMINATION 2024**[4<sup>th</sup> Year; 1<sup>st</sup> Semester]**Advanced Pavement Engineering**

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)**

Answer All (5 × 10 = 50)

1. Explain the general selection process of different Ground Improvement Methods applicable for Highway Pavements. CO2
2. 'Sheep's Foot Roller' and 'Vibratory Roller' are better for compacting 'Clayey Soil' and 'Sandy Soil', respectively. Justify the statement CO3
3. Explain the reinforcing action of 'Geogrid' and 'Geocell' in distributing the surface load coming from vehicles in to the subgrade. CO2
4. 'Pavement quality can be increased by increasing the quality of its subgrade' – Justify. CO3
5. What is 'Soil Stabilization'? What is the basic difference between 'Cement Stabilization' and 'Lime Stabilization'? CO2
6. What is the significance of 'Standard/Heavy Proctor Test' conducted in laboratory with respect to field application? CO3
7. Define the method 'Pre-Loading with Vertical Drain' with schematic diagram. How is it helpful for any Civil-Construction? CO2
8. What are the signs that indicates a pavement need to be improved? CO3
9. What are the quality control checks for a fresh pavement construction? CO3
10. When the tack, prime, and seal coat are given and how they work in a pavement construction? CO3