Major Test – CVL381: Design of Hydraulic Structures-Dams Part

27 Marks

Q. 1. Estimate the following loads for the gravity dam section shown in Figure

(a) Forces due to Uplift Pressure at the section AA' **(3 Marks)**

(b) Forces at the section CC' and moments wrt **C'** due to Earthquake acceleration in horizontal upstream direction **(8 Marks)**

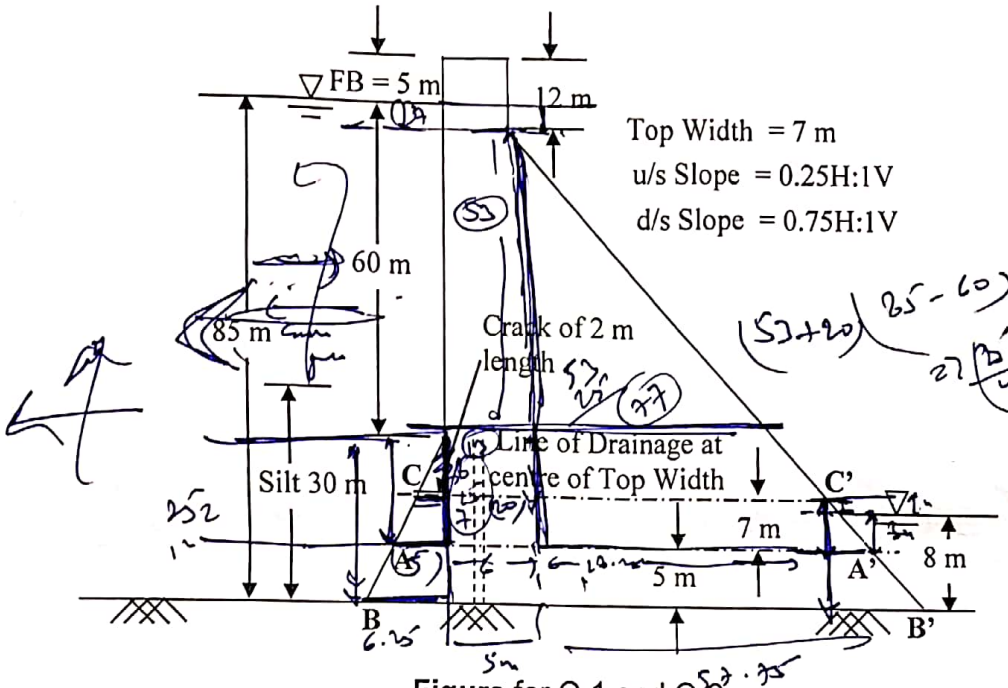

Figure for Q.1 and Q.2

Data for Q.1 and Q.2

Dam is located in zone V ($\alpha_0 = 0.08$, $F_0 = 0.4$)

Unit Weights – 10 kN/m^3; 13.6 kN/m^3; 19.25 kN/m^3; 24 kN/m^3

$\sigma_{c.per} = 3.5$ N/mm^2; $\tau_{c.per} = 1.4$ N/mm^2; $\mu = 0.65$

$F_\phi = 1.5$ & $F_c = 3.6$ for Load combination A, B, & C and

$F_\phi = 1.2$ & $F_c = 1.4$ for Load combination D, & E

$$C_s = \frac{0.735}{2}\left(1-\frac{\theta}{90}\right)\left\{\frac{y}{h}\left(2-\frac{y}{h}\right)+\sqrt{\frac{y}{h}\left(2-\frac{y}{h}\right)}\right\}$$

Q. 2. Determine the following for a gravity dam section shown in Figure with indicative forces and moments as listed in the table **(2.5 Marks each)**

(a) FS against sliding at BB' for the load combination B,

(b) Principal stress at **B** for the load combination D,

(c) Shear stress at **B** for the load combination B, and

(d) Normal stress at **B'** for the load combination E

Table for Q.2: Forces (in kN) and Moments (in MN.m)

Force Description	Force at **BB'**	Moment about **B'**
Dead load (Self Weight)	71751	3200
Reservoir water+silt force (Horizontal)	37745	1040
Vertical component of Res. Water+silt force	4925	316
Uplift force	13620	576
Hydrodynamic force (Horizontal)	9252.8	325
Vertical component of hydrodynamic force	550	41.4
Tail water force (Horizontal)	320	0.85
Vertical component of Tail water force	240	0.48
Inertia force due to horizontal Earthquake acceleration	7515	288
Inertia force due to vertical Earthquake acceleration	3757.5	155
Wave force	50	4.3

Q.3 Answer the following **(1.5+1.5+3 Marks)**

a) Now a days embankment dams are more common. List four main reasons in support of this statement.

b) A concrete mix (σ_{cc} = 4.1 N/mm^2, S_c = 2.4) was used in a 108 m high gravity dam. Assuming intermediate uplift (C = 0.6), compute the limiting height and then identify the type of the dam.

c) Compute the quantity of seepage through per unit length of the embankment dam sections shown below