Course Code: 16CE140 **R16**

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY:: PUTTUR
(AUTONOMOUS)
Siddharth Nagar, Narayanavanam Road – 517583

QUESTION BANK (DESCRIPTIVE)

Subject with Code: Design and Drawing of Irrigation Structures (16CE140)
Course & Branch: B.Tech & CE
Year & Sem: IV-B.Tech & II-Sem **Regulation:** R16

UNIT-I
DESIGN AND DRAWING OF SLOPING GLACIS WEIR

1	Design a sloping glacis weir with the following hydraulic particulars. U/S D/S Full supply discharge : 7.5 cumecs 7.5 cumecs Bed width : 6.0 m 6.0 m Bed level : + 10.00 + 8.00 F.S.D. (Full Supply Depth) : 1.5 m 1.5 m F.S.L. : + 11.50 + 9.50 Top of Bank Level : + 12.50 + 10.50 Hard soil is available for foundations below + 8.00 level Draw the following: a) Plan b) Sectional Elevation	[L4][CO1]	**[60M]**
2	Design the sloping glacis weir across the stream for the following data: U/S D/S Full supply discharge : 7.0 cumecs 7.0 cumecs Bed width : 6.0 m 6.0 m Bed level : + 12.00 + 10.00 F.S.D. (Full Supply Depth) : 1.5 m 1.5 m F.S.L. : + 13.50 + 11.50 Top of Bank Level : + 14.50 + 12.50 Hard soil is available for foundations below + 10.00 level Draw the following: a) Plan b) Sectional Elevation	[L4][CO1]	**[60M]**
3	Design the sloping glacis weir across the stream for the following data: **Hydraulic particulars** / **Up-stream of drop** / **Downstream of drop** Full supply discharge / 9.0 m^3/sec / 9.0 m^3/sec Bed width / 6.5 m / 6.5 m Bed level / + 19.00 / + 17.00 Full supply depth / 1.60 m / 1.60 m F.S.L / + 20.60 / + 18.60 Top of bank level(T.B.L) / + 21.60 / + 19.60 Hard strata is available below + 17.00 level for foundation. Draw the plan and sectional elevation to the suitable scale	[L4][CO1]	**[60M]**

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<table>
<tr><td>4</td><td>Design the sloping glacis weir across the stream for the following data:

<table><tr><th>Hydraulic particulars</th><th>Up-stream of drop</th><th>Downstream of drop</th></tr><tr><td>Full supply discharge</td><td>7.5 m^3/sec</td><td>7.5 m^3/sec</td></tr><tr><td>Bed width</td><td>6.0 m</td><td>6.0 m</td></tr><tr><td>Bed level</td><td>+ 10.00</td><td>+ 8.00</td></tr><tr><td>Full supply depth</td><td>1.50 m</td><td>1.50 m</td></tr><tr><td>F.S.L</td><td>+ 11.50</td><td>+ 9.50</td></tr><tr><td>Top of bank level(T.B.L)</td><td>+ 12.50</td><td>+ 10.50</td></tr></table>Hard strata is available below + 8.00 level for foundation.
Draw the plan and sectional elevation to the suitable scale</td><td>[L4][CO1]</td><td>[60M]</td></tr>
<tr><td>5</td><td>Design the sloping glacis weir across the stream for the following data:

<table><tr><td></td><td></td><td><u>U/S</u></td><td><u>D/S</u></td></tr><tr><td>Full supply discharge</td><td>:</td><td>8.0 cumecs</td><td>8.0 cumecs</td></tr><tr><td>Bed width</td><td>:</td><td>6.0 m</td><td>6.0 m</td></tr><tr><td>Bed level</td><td>:</td><td>+ 12.00</td><td>+ 10.00</td></tr><tr><td>F.S.D. (Full Supply Depth)</td><td>:</td><td>1.5 m</td><td>1.5 m</td></tr><tr><td>F.S.L.</td><td>:</td><td>+ 13.50</td><td>+ 11.50</td></tr><tr><td>Top of Bank Level</td><td>:</td><td>+ 14.50</td><td>+ 12.50</td></tr></table>Hard soil is available for foundations below + 10.00 level
<u>Draw the following</u>:
a) Plan
b) Sectional Elevation</td><td>[L4][CO1]</td><td>[60M]</td></tr>
</table>

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UNIT-II
DESIGN AND DRAWING OF SURPLUS WEIR

1	Design a surplus weir for a minor tank forming a group of tanks with the following data: Combined catchment area = 25.89 km^2 Intercepted catchment area = 20.71 km^2 Top width of the bund = 2 m Side slopes of the bund = 2:1 on both sides Top level of bund = + 14.50 Maximum Water Level (MWL) = + 12.75 Full Tank Level (FTL) = + 12.00 General ground level at the site = + 11.00 Ground level slopes off to a level = + 10.00 in about 6 m distance The foundations are of hand gravel = + 9.50 Saturation gradient = 4:1 with 1 m clean cover Provision is to be made to store water up to MWL in-times of necessity Draw the following: (a) Half plan at top and half plan at foundation level (b) Half longitudinal section and half longitudinal elevation	[L4][CO1]	**[60M]**
2	Design a surplus weir for a minor tank forming a group of tanks with the following data: Combined catchment area = 35 km^2 Intercepted catchment area = 10 km^2 Top width of the bund = 2 m Side slopes of the bund = 2:1 on both sides Top level of bund = + 12.25 Maximum Water Level (MWL) = + 10.75 Full Tank Level (FTL) = + 10.00 General ground level at the site = + 8.50 Ground level slopes off to a level = + 8.00 in about 6 m distance The foundations are of hand gravel = + 7.00 Saturation gradient = 4:1 with 1 m clean cover Provision is to be made to store water up to MWL in-times of necessity Draw the following: (a) Half plan at top and half plan at foundation level (b) Half longitudinal section and half longitudinal elevation	[L4][CO1]	**[60M]**
3	Design the surplus work of a tank forming part of a chain of tanks. The combined catchment area of the group of tanks is 25.89 sq. kilometers and the area of the catchment intercepted by the upper tanks is 20.71 sq. kilometers. It is decided to store water in the tank to a level of +11.00 meters above M.S.L. (Mean Sea Level) limiting the submersion of foreshore lands up to a level of +11.75 meters above M.S.L. The general ground level at the proposed site of work is +10.00 meters, and the ground level below the proposed surplus slopes off till it reaches +09.00 meters in about 6 meters distance.	[L4][CO1]	**[60M]**

	The tank bund has a top width of 2 meters at level +13.50 with 2:1 side slopes on eitherside. The tank bunds are designed for a saturation gradient of 4:1 with 1 meter clear cover.Provision may be made to make kutcha regulating arrangements to store water up to M.W.L. at times of necessity. The foundations are of hard gravel at a level of 8.50 meters near the site of work. Also draw the plan and longitudinal section.		
4	Design a surplus weir for a minor tank forming a group of tanks with the following data: Combined catchment area = 25.89 km^2 Intercepted catchment area = 20.71 km^2 Top width of the bund = 2 m Side slopes of the bund = 2:1 on both sides Top level of bund = + 14.50 Maximum Water Level (MWL) = + 12.75 Full Tank Level (FTL) = + 12.00 General ground level at the site = + 11.00 Ground level slopes off to a level = + 10.00 in about 6 m distance The foundations are of hand gravel = + 9.50 Saturation gradient = 4:1 with 1 m clean cover Provision is to be made to store water up to MWL in-times of necessity <u>Draw the following:</u> (a) Half plan at top and half plan at foundation level (b) Section across weir	[L4][CO1]	**[60M]**
5	Design a surplus weir for a minor tank forming a group of tanks with the following data: Combined catchment area = 35 km^2 Intercepted catchment area = 10 km^2 Top width of the bund = 2 m Side slopes of the bund = 2:1 on both sides Top level of bund = + 12.25 Maximum Water Level (MWL) = + 10.75 Full Tank Level (FTL) = + 10.00 General ground level at the site = + 8.50 Ground level slopes off to a level = + 8.00 in about 6 m distance The foundations are of hand gravel = + 7.00 Saturation gradient = 4:1 with 1 m clean cover Provision is to be made to store water up to MWL in-times of necessity <u>Draw the following:</u> (a) Half plan at top and half plan at foundation level (b) Section across weir	[L4][CO1]	**[60M]**

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UNIT-III
DESIGN AND DRAWING OF TANK SLUICE WITH A TOWER HEAD

1	Design a tank sluice with tower head for the data given below: Ayacut to be irrigated = 200 ha Duty = 1000 ha/cumec Top width of the tank bund = 2m with 2:1 side slopes The top level of bank = + 40.00 The ground level at the site = + 34.50 Hard soil for foundation = + 33.50 The sill of the sluice at off take = + 34.00 The maximum water level in tank = + 38.00 The Full Tank Level = + 37.00 Average low water level of the tank = + 35.00 The channel bed level = + 34.00 Full supply level = + 34.50 Bed width = 1.25 m Side slopes of channel = 1.5 to 1 with top of bank at + 35.50 <u>Draw the following:</u> (a) Half plan at top & half plan at foundation level (b) Longitudinal section through the barrel	[L4][CO1]	**[60M]**
2	Design a tank sluice with tower head for the data given below: Ayacut to be irrigated = 200 ha Duty = 900 ha/cumec Top width of the tank bund = 2m with 2:1 side slopes The top level of bank = + 140.00 The ground level at the site = + 134.50 Hard soil for foundation = + 133.50 The sill of the sluice at off take = + 134.00 The maximum water level in tank = + 138.00 The Full Tank Level = + 137.00 Average low water level of the tank = + 135.00 The channel bed level = + 134.00 Full supply level = + 134.50 Bed width = 1.25 m Side slopes of channel = 1.5 to 1 with top of bank at +135.50 <u>Draw the following:</u> (a) Half plan at top & half plan at foundation level (b) Longitudinal section through the barrel	[L4][CO1]	**[60M]**
3	Design a tank sluice with tower head for the data given below: Ayacut to be irrigated = 400 ha Duty = 1000 ha/cumec Top width of the tank bund = 3m with 2:1 side slopes The top level of bank = + 40.00 The ground level at the site = + 34.50 Hard soil for foundation = + 33.50 The sill of the sluice at off take = + 34.00 The maximum water level in tank = + 38.00 The Full Tank Level = + 37.00 Average low water level of the tank = + 35.00 The channel bed level = + 34.00	[L4][CO1]	**[60M]**

	Full supply level = + 34.50 Bed width = 1.25 m Side slopes of channel = 1.5 to 1 with top of bank at + 35.50 Draw the following: (a) Half plan at top & half plan at foundation level (b) Longitudinal section through the barrel		
4	Design a sluice taking off from a tank irrigating 200 hectares at 1000 ha/cumec duty. The tank bund through which the sluice is taking off has a top width of 2 meters with 2:1 side slopes. The top level of bank is +40.00 and the ground level at site is +34.50. Good hard soil for foundation is available at +33.50. The sill of the sluice at off-take is +34.00. The maximum water level in tank is +38.00. The full tank level is +37.00. Average low water level of the tank is +35.00. The details of the channel below the sluice are as under. Bed level +34.00 F.S.L. +34.50 Bed width 1.25 meters Side slope 1.5 to 1 with top of bank at +35.50. Also draw the plan and longitudinal section.	[L4][CO1]	**[60M]**
5	Design a tank sluice with tower head for the data given below: Discharge = 0.2 cumec Top width of the tank bund = 2m with 2:1 side slopes The top level of bank = + 40.00 The ground level at the site = + 34.50 Hard soil for foundation = + 33.50 The sill of the sluice at off take = + 34.00 The maximum water level in tank = + 38.00 The Full Tank Level = + 37.00 Average low water level of the tank = + 35.00 The channel bed level = + 34.00 Full supply level = + 34.50 Bed width = 1.25 m Side slopes of channel = 1.5 to 1 with top of bank at + 35.50 Draw the following: (a) Half plan at top & half plan at foundation level (b) Longitudinal section through the barrel	[L4][CO1]	**[60M]**

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UNIT –IV
DESIGN AND DRAWING OF TYPE – III SYPHON AQUEDUCT

1	Design a syphon aqueduct Type – III for the following data: **Canal:** Discharge = 35 m^3/s Bed width = 20.00 m Bed Level = + 40.00 Full supply level = + 42.00 Ultimate Bed level = + 39.75 Ultimate full supply level = + 42.50 Average velocity in the canal = 0.83 m/s Left bank top width = 5.00 m Right bank top width = 2.00 m Canal side slopes both inside and outside = 2:1 Top of canal bank = + 43.50 **Drain :** Catchment area = 8.0 km^2 Maximum computed discharge = 60 m^3/s Maximum flood level of the drain at the site crossing = + 39.75 (observed) Average bed level of the drain at the site crossing = + 38.00 Hard soil is available at = + 37.00 Draw the following: a) Half plan at top and half plan at foundation b) Section across syphon barrel	[L4][CO1]	**[60M]**
2	Design a syphon aqueduct Type – III for the following data: **Canal:** Discharge = 35 m^3/s Bed width = 20.00 m Bed Level = + 40.00 Full supply level = + 42.00 Ultimate Bed level = + 39.75 Ultimate full supply level = + 42.50 Average velocity in the canal = 0.83 m/s Left bank top width = 5.00 m Right bank top width = 2.00 m Canal side slopes both inside and outside = 2:1 Top of canal bank = + 43.50 **Drain :** Catchment area = 8.0 km^2 Maximum computed discharge = 60 m^3/s Maximum flood level of the drain at the site crossing = + 39.75 (observed) Average bed level of the drain at the site crossing = + 38.00 Hard soil is available at = + 37.00 Draw the following: a) Half plan at top and half plan at foundation b) Longitudinal section along barrel	[L4][CO1]	**[60M]**

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3	Design a syphon aqueduct Type – III for the following data: **Canal:** Discharge = 35 m^3/s Bed width = 20.00 m Bed Level = + 40.00 Full supply level = + 42.00 Ultimate Bed level = + 39.75 Ultimate full supply level = + 42.50 Average velocity in the canal = 0.83 m/s Left bank top width = 5.00 m Right bank top width = 2.00 m Canal side slopes both inside and outside = 2:1 Top of canal bank = + 43.50 **Drain :** Catchment area = 8.0 km^2 Maximum computed discharge = 60 m^3/s Maximum flood level of the drain at the site crossing = + 39.75 (observed) Average bed level of the drain at the site crossing = + 38.00 Hard soil is available at = + 37.00 Draw the following: a) Half plan at top and half plan at foundation b) Elevation from D/S drain and section through road arches	[L4][CO1]	**[60M]**
4	Design a syphon aqueduct Type – III for the following data: **Canal:** Discharge = 36 m^3/s Bed width = 20.00 m Bed Level = + 40.00 Full supply level = + 42.00 Ultimate Bed level = + 39.75 Ultimate full supply level = + 42.50 Average velocity in the canal = 0.83 m/s Left bank top width = 5.00 m Right bank top width = 2.00 m Canal side slopes both inside and outside = 2:1 Top of canal bank = + 43.50 **Drain :** Catchment area = 8.0 km^2 Maximum computed discharge = 60 m^3/s Maximum flood level of the drain at the site crossing = + 39.75 (observed) Average bed level of the drain at the site crossing = + 38.00 Hard soil is available at = + 37.00 Draw the following: a) Half plan at top and half plan at foundation b) Section across syphon barrel	[L4][CO1]	**[60M]**

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5	Design a syphon aqueduct Type – III for the following data: **<u>Canal</u>:** Discharge = 36 m^3/s Bed width = 20.00 m Bed Level = + 40.00 Full supply level = + 42.00 Ultimate Bed level = + 39.75 Ultimate full supply level = + 42.50 Average velocity in the canal = 0.83 m/s Left bank top width = 5.00 m Right bank top width = 2.00 m Canal side slopes both inside and outside = 2:1 Top of canal bank = + 43.50 **<u>Drain :</u>** Catchment area = 8.0 km^2 Maximum computed discharge = 60 m^3/s Maximum flood level of the drain at the site crossing = + 39.75 (observed) Average bed level of the drain at the site crossing = + 38.00 Hard soil is available at = + 37.00 <u>Draw the following:</u> a) Half plan at top and half plan at foundation b) Longitudinal section along barrel	[L4][CO1]	**[60M]**

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UNIT –V
DESIGN AND DRAWING OF CANAL REGULATOR

1	Design a regulator cum road bridge with the following data: **Hydraulic particulars of canal upstream:** Full supply discharge : 20 m^3/s Bed width : 15 m Bed Level : + 20.00 Full Supply Depth : 2.0 m F.S.L. : + 22.00 Top level of bank : + 23.00 The right bank is 5 m wide and left bank is 2 m wide **Hydraulic particulars of canal downstream** : Full supply discharge : 16 m^3/s Bed width : 15 m Bed Level : + 20.00 Full Supply Depth : 1.75 m F.S.L. : + 21.75 Top Level of Bank : + 22.75 Good foundation soil is available at : + 19.00 The general ground level at site : + 22.00 Top width of banks are the same as those on the upstream side. The regulator carries a road way single lane designed for IRC loading class 'A' provide clear free board of one meter above F.S.L. for the road bridge. Also draw the plan and longitudinal section	[L4][CO1]	**[60M]**
2	Design a regulator cum road bridge with the following data : **Hydraulic particulars of canal upstream:** Full supply discharge : 18 m^3/s Bed width : 14 m Bed Level : + 15.00 Full Supply Depth : 2.0 m F.S.L. : + 17.00 Top level of bank : + 18.00 The right bank is 5 m wide and left bank is 2 m wide **Hydraulic particulars of canal downstream**: Full supply discharge : 12 m^3/s Bed width : 14 m Bed Level : + 15.00 Full Supply Depth : 1.60 m F.S.L. : + 16.60 Top Level of Bank : + 17.60 Good foundation soil is available at : + 14.00 The general ground level at site : + 17.00 Top width of banks are the same as those on the upstream side. The regulator carries a road way single lane designed for IRC loading class 'A' provide clear free board of one meter above F.S.L. for the road bridge.	[L4][CO1]	**[60M]**

<table>
<tr><td>3</td><td>Design a regulator cum road bridge with the following data and draw half plan at foundation and longitudinal section
<table>
<tr><th>Hydraulic particulars</th><th>U/S canal</th><th>D/S canal</th></tr>
<tr><td>Full supply discharge</td><td>22 m^3/s</td><td>16 m^3/s</td></tr>
<tr><td>Bed width</td><td>15 m</td><td>15 m</td></tr>
<tr><td>Bed Level</td><td>+20.00</td><td>+20.00</td></tr>
<tr><td>Full Supply Depth</td><td>2 m</td><td>1.75 m</td></tr>
<tr><td>F.S.L</td><td>+22.00</td><td>+21.75</td></tr>
<tr><td>Top level of bank</td><td>+23.00</td><td>+22.75</td></tr>
</table>
Top width of banks is the same as those on the upstream side. The regulator carries a road way single lane designed for IRC loading class ‘A’ provides clear free board of one meter above F.S.L. for the road bridge.
The right bank is 5 m wide and left bank is 2 m wide on both U/S and D/S. Good foundation soil is available at + 19.00 m and ground level +22.00</td><td>[L4][CO1]</td><td>[60M]</td></tr>
<tr><td>4</td><td>Design a regulator cum road bridge with the following data and draw half plan at foundation and longitudinal section
<table>
<tr><th>Hydraulic particulars</th><th>U/S canal</th><th>D/S canal</th></tr>
<tr><td>Full supply discharge</td><td>16 m^3/s</td><td>12 m^3/s</td></tr>
<tr><td>Bed width</td><td>14 m</td><td>14 m</td></tr>
<tr><td>Bed Level</td><td>+15.00</td><td>+15.00</td></tr>
<tr><td>Full Supply Depth</td><td>2 m</td><td>1.60 m</td></tr>
<tr><td>F.S.L</td><td>+17.00</td><td>+16.60</td></tr>
<tr><td>Top level of bank</td><td>+18.00</td><td>+17.60</td></tr>
</table>
Top width of banks are the same as those on the upstream side. The regulator carries a road way single lane designed for IRC loading class ‘A’ provide clear free board of one meter above F.S.L. for the road bridge.
The right bank is 5 m wide and left bank is 2 m wide on both U/S and D/S. Good foundation soil is available at + 14.00 m and ground level +17.00</td><td>[L4][CO1]</td><td>[60M]</td></tr>
<tr><td>5</td><td>Design a regulator cum road bridge with the following data and draw half plan at foundation and longitudinal section
<table>
<tr><th>Hydraulic particulars</th><th>U/S canal</th><th>D/S canal</th></tr>
<tr><td>Full supply discharge</td><td>21 m^3/s</td><td>16 m^3/s</td></tr>
<tr><td>Bed width</td><td>15 m</td><td>15 m</td></tr>
<tr><td>Bed Level</td><td>+20.00</td><td>+20.00</td></tr>
<tr><td>Full Supply Depth</td><td>2 m</td><td>1.75 m</td></tr>
<tr><td>F.S.L</td><td>+22.00</td><td>+21.75</td></tr>
<tr><td>Top level of bank</td><td>+23.00</td><td>+22.75</td></tr>
</table>
Top width of banks is the same as those on the upstream side. The regulator carries a road way single lane designed for IRC loading class</td><td>[L4][CO1]</td><td>[60M]</td></tr>
</table>

	'A' provides clear free board of one meter above F.S.L. for the road bridge. The right bank is 5 m wide and left bank is 2 m wide on both U/S and D/S. Good foundation soil is available at + 19.00 m and ground level +22.00		

Prepared by:
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