(b) Fix
c

Code : 011725

B.Tech 7th Semester Exam., 2015

DESIGN OF HYDRAULIC STRUCTURES

Time : 3 hours *Full Marks* : 70

Instructions :

(i) The marks are indicated in the right-hand margin.

*(ii) There are **NINE** questions in this paper.*

*(iii) Attempt **FIVE** questions in all.*

*(iv) Question No. **1** is compulsory.*

(v) Assume any suitable data, if required.

1. Choose the correct alternative any *seven* of the following : 2×7=14

(a) Weir is a solid obstruction constructed across a

(i) river

(ii) canal

(iii) level crossing

(iv) None of the above

(b) Masonry or concrete slopping weirs are suitable for soft sandy foundations.

(i) True

(ii) False

(c) Fish ladder is provided for uninterrupted movement of fish such that

(i) a maximum velocity of 3 m/s is maintained to allow the fish to move upstream

(ii) a maximum velocity of 5·5 m/s is maintained to allow the fish to move upstream

(iii) water is still

(iv) None of the above

(d) A canal fall is a control structure

(i) located at a place where the country slope is flatter than the canal bed slope

(ii) located most economically where the depth of cutting is less than the balancing depth

(iii) the location of which is independent of the command to be served

(iv) designed to secure raising of water surface on its upstream

(e) In a Sarda type fall, rectangular crest is designed for discharge

(i) up to 14 m^3/s

(ii) >14 m^3/s

(iii) up to 5 m^3/s

(iv) unlimited

(f) In an unflumed straight glacis non-meter fall, the length of the crest is

(i) half of the width of canal

(ii) equal to velocity head of approach

(iii) equal to width of canal

(iv) None of the above

(g) Gibbs' module is a type of outlet which ensures

(i) constant discharge even if the water levels in the supply channel and watercourse fluctuate

(ii) variable discharge as per need

(iii) constant discharge into the water-course when the water levels in the supply channel vary

(iv) constant discharge for varying water levels in the watercourse for a given water level in the supply channel

(h) Modular limit of a canal outlet is the ratio of

(i) rate of change of discharge of outlet to that of distributary

(ii) water depth above outlet crest to the full supply depth of the channel

(iii) water depth above the crest on downstream to that on upstream of outlet

(iv) rate of change of discharge of outlet to the rate of change of water level of the channel

(i) Which of the following methods is used for designing a channel transition when the depth of flow varies in the channel?

(i) Mitra's hyperbolic transition

(ii) Chaturvedi's semi-cubical parabolic transition

(iii) Hind's method

(iv) None of the above

(j) The overflow dam is a/an

(i) gravity dam

(ii) earthen dam

(iii) weir

(iv) None of the above

2. (a) Write the step-by-step procedure for design of non-erodible channel using tractive force approach. 6

(b) Design a stable non-erodible channel to carry 10 m^3/s of clear water through a 10 mm bed of rounded gravel. A longitudinal slope of 0·0008 and side slope of 2H : 1V are to be adopted. Take $\phi = 32°$. Assume other data suitably, if required. 8

3. (a) Discuss the various causes of failure of weirs and their remedies. 5

(b) A river discharges 1000 cumec of water at high flood level of RL 103 m. A weir is constructed for flow diversion with a crest length of 255 m and total length of concrete floor as 40 m. The weir has to sustain the under seepage at a maximum static head of 2·4 m. The silt factor is 1·1 and safe exist gradient is 1/6. Determine the depth of cutoff required at the downstream end of the concrete floor. Take the level of downstream concrete floor as RL 100 m. Check for exist gradient. 9

4. (a) State the Bligh's creep theory for seepage below a weir. 4

(b) An impervious floor of a weir on permeable soil is 22 m long and has sheet piles at both ends. The upstream pile is 4 m and downstream pile is 6 m deep. The weir creates a head of 3 m. Neglecting the thickness of the weir floor, calculate the uplift pressures at the junction of the inner faces of the pile with the weir floor, by using Khosla's theory. 10

5. (a) What are the functions of a canal head regulator? 4

(b) Fix suitable values for the waterway, crest levels of weir and under sluices for the data : 10

HFD = 7300 m^3/s,
HFL (before the construction of barrage) = 150·0 m
RBL = 143·5 m
Permissible afflux = 1·0 m
Silt factor = 1·1

6. (a) What are canal falls and why are they constructed? 6

(b) Design the size and number of notches required for a canal drop with the following data :

Full supply discharge = 20 cumecs
Bed width = 14 m
Full supply depth = 1·9 m

Assume any data, if required. 8

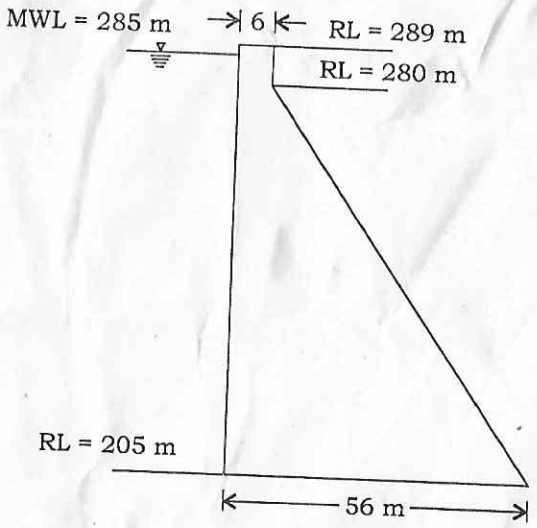
7. Design a 1·5 m Sarda type fall for a canal having a discharge of 12 cumecs, with the following data : 14

Bed level upstream = 103·0 m
Side slopes of channel = 1 : 1 m
Bed level downstream = 101·5 m
Full supply level upstream = 104·5 m
Bed width u/s and d/s = 1·0 m
Soil = Good loam

Assume Bligh's coefficient = 6.

(Continued)

8. For the given section of a gravity dam, calculate (neglecting earthq effect) the maximum vertical stresses the heel and toe of the dam. Assume wt. of concrete = 23·5 kN/m^3 : 14



9. Write notes on any *three* of the following : 14

(a) Fish ladder
(b) Maintenance of unlined canal
(c) Ogee spillways
(d) Transition of canal
(e) Canal syphon

★ ★ ★