KATHMANDU UNIVERSITY
End Semester Examination
February/March, 2019

Marks scored:

Level : B.E.
Year : III
Course : CIEG 304
Semester : I

Exam. Roll No. :
Time: 30 mins.
F. M. : 10

Registration No.:
Date : 06 MAR 2019

SECTION "A"
[20 Q × 0.5 = 10 marks]

Encircle the most appropriate answer.

1. The D_{15} size of the filter material should not be larger than .....times the D_{85} size of the protected soil
   a. 5 times b. 15 times c. 40 times d. 4 times

2. If the straight length of the water expansion is 40 km and wind velocity is 50 km/hr, then wave height (h_w) for the hydrodynamic force calculation on the dam is
   a. 1.3 m b. 1.4 m c. 1.2 m d. 1.5 m

3. For the silt in reservoir, if an internal angle of friction is (Φ=25 Degree), the reciprocal of the coefficient of the an active earth pressure is
   a. 0.406 b. 2.46 c. 0.33 d. 3

4. For gravity dam analysis, for the particular dam in specified site, factor of safety against sliding (FSS) must be .... shear friction factor (SFF).
   a. Less than b. More than c. Equal to d. Can't be predicted

5. As per **USBR recommendation** the minimum free board over MWL should be .....(for the earth dam with controlled spillway and dam height more than 60 meter)
   a. Between 2 to 3 meter
   b. 2.5 meter above the top of the gate
   c. 3 meter above the top of the gate
   d. 3.5 meter above the top of the gate

6. As per **Terzaghi,** Side slope (H:V) for earth dam in case of homogeneous well graded material type is
   a. U/S slope 2.5:1 and D/S slope 2:1
   b. U/S slope 3:1 and D/S slope 2.5:1
   c. U/S slope 2:1 and D/S slope 2.5:1
   d. U/S slope 2.5:1 and D/S slope 3:1

7. A flow net is plotted for a homogeneous earthen dam of height 22 m and freeboard 2.0 meter. If the number of potential drop and number of flow channel are 10 and 4 respectively & coefficient of the permeability of earth is $5x10^{-4}$ cm/sec. Discharge per meter run of the dam is
   a. 6×10^{-6} Cumecs b. 4×10^{-6} Cumecs c. 2×10^{-6} Cumecs d. 3×10^{-6} Cumecs

8. Photo electric studies shows that, the maximum intensity of shear stress occurs at the distance of ..... From the heel (in case of slope stability analysis of U/S face of earthen dam during sudden drawdown considering the effect of the horizontal shear stress developed at the base of U/S face)
   a. 0.4B b. 0.6B c. 0.5B d. 0.3B

   Where B is the vertical projection of the U/S face of the dam.

9. If design head of the Ogee spillway is H_d =20 m, and if the U/S face of the spillway is vertical, then U/S profile of the spillway extends up to .....from the Crest of the spillway.
   a. 4.5 meter towards D/S
   b. 4.5 meter toward U/S
   c. 5.4 meter towards D/S
   d. 5.4 meter towards U/S

10. If a Chute spillway is constructed in continuation to the dam at one end, it may be called.....
   a. Saddle Weir
   b. Trough Weir
   c. Flank Weir
   d. Waste Weir

11. Maximum height of a single pour of concrete (lift) generally in concrete gravity dam is
   a. 3 meter
   b. 2 meter
   c. 1 meter
   d. 1.5 meter

12. For the location of the center of the critical slip circle (Fellenius Method), if the Side slope of the dam is **(2:1, H:V)** then to find the line passing from toe/heel of the dam the angle made by that line with slope side is ....
   a. 27.5 Degree
   b. 35 Degree
   c. 25 Degree
   d. 37 Degree

13. In Ogee spillway the profile of the spillway is determined based on
   a. Profile of the lower Nappe
   b. Profile of the Upper nappe
   c. Profile of the free water level
   d. Profile of the mid water level

14. Most accurate method for the analysis of an arch dam is
   a. Thin cylinder theory
   b. Thick cylinder method
   c. Theory of elastic arches
   d. Trial load method

15. Slenderness ratio (ratio of the Height of the Buttress to the thickness of the Buttress) for the buttress dam is generally between
   a. 2.5 to 3
   b. 10 to 12
   c. 12 to 15
   d. 15 to 20

16. If the operating head on an Ogee spillway is more than the design head, then: the pressure on the crest will be
   a. Zero
   b. Negative causing Cavitation
   c. Positive
   d. Discharge coefficient of the spillway will be reduced

17. **Kaligandaki A** hydropower dam located in Syangja Nepal is
   a. Earthen dam
   b. Rock fill dam
   c. Concrete gravity dam
   d. Hollow gravity dam

18. The **Kulekhani Dam** is a Rock fill dam on the Kulekhani river in Makwanpur Nepal, with dam height of
   a. 114 meter
   b. 124 meter
   c. 263 meter
   d. 94 meter

19. The water stored in the reservoir below the minimum pool level is called
   a. Valley storage
   b. Minimum storage
   d. Dead storage
   d. Useful storage

20. In an arch dam, the "**Extrodos curves**" refer to the arch rings corresponding to the :
   a. D/S face of the Dam
   b. U/S face of the Dam
   c. Either U/S face or D/S face
   d. Central arch of the dam

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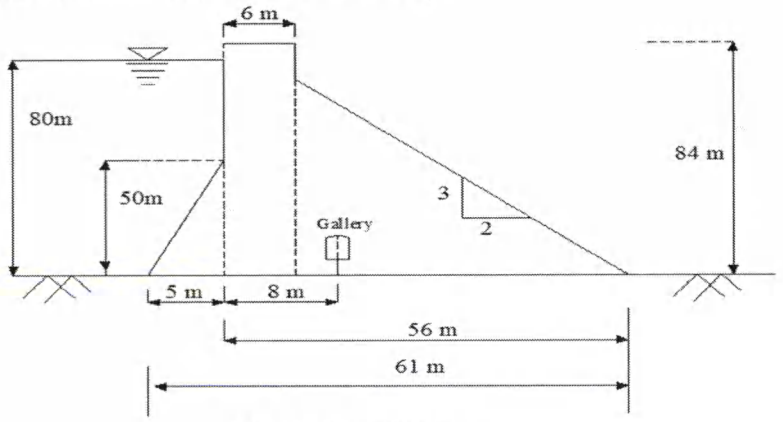
SECTION "B"

Attempt *ALL* questions.

1. Define hydraulics Structures? Explain the concept of the development of the hydraulic engineering? As a dam engineer what factors will you consider for the selection of the type of dam for particular site? Explains in detail. [2+2]

2. Explain the effect of the tension crack on dam? Derive the expression for the stresses developed in the elementary profile of a dam? [1+3]

3. Examine the stability of the dam section shown below. Also calculate the various kinds of the stresses on the heel and toe of the dam. (Unit weight of water and concrete (γ_w and γ_c) are 10 kN/m^2 and 24 kN/m^3 respectively and take allowable stress in the concrete as 3000 kN/m^2, Given average shear at the dam base is 1400 kN/m^2 and Coefficient of friction between dam base and dam is 0.75) [4+3]



Section of Dam

4. What are the different types of the earthen dams? Explain with suitability of each. List out the causes of failure of the earthen dam and explain critically about the hydraulic failure in earthen dam with its mitigation measures. [2+1+2]

5. An Earth Dam made up of homogeneous material has the following data:
Level of top of the dam =210.0 m
Level of river bed U/S and D/S = 180.0 m
H.F.L. of reservoir = 205.0 m
Top width of the dam = 8 m
U/S slope = 3:1 (H: V) and D/S slope = 1.5:1 (H: V)
Coefficient of permeability of the dam material = 5 X 10^{-4} (cm/sec.)
Find out the data for phreatic line for this dam section & and find out the seepage discharge. [4]

6. Explain the expression for the stability analysis of the U/S slope of the earthen dam section during sudden drawdown from the consideration of the horizontal shear at the base of the U/S slope of the dam. [4]

7. Using thin cylinder theory, derive the limiting height of the arch dam? Design a constant angle economical arch dam for a valley of 30 meter width at the base and 150 meter width at a height of 50 meter. Allowable stress of the concrete is 5 MPa. Assume top width of the dam as 1.5 meter, and assume suitable data if needed. [2+3]

8. What are the essential requirements of a spillway? Differentiate between main, auxiliary & emergency spillway with neat sketch. [1+2]

9. Sketch the plan view of fixed, simply supported and cantilever buttress dam showing rebar detailing. Show the elements of the rock fill dam with neat sketch. [3+1]