KATHMANDU UNIVERSITY
End Semester Examination
March/April, 2017

Marks scored:

Level : B.E.
Year : III
Course : CIEG 301
Semester : I
Exam Roll No. :
Time: 30 mins.
F. M. : 10
Registration No.:
Date : MAR 2 6 2017

SECTION "A"
[20 Q × 0.5 = 10 marks]

Tick (✓) the most appropriate answer.

1. Newton's law of viscosity states that
   a. Shear stress is directly proportional to the velocity
   b. Shear stress is directly proportional to the velocity gradient
   c. Shear stress is directly proportional to shear strain
   d. Shear stress is directly proportional to the viscosity

2. Hydraulic radius is equal to the
   a. Area divided by the square of the wetted perimeter
   b. Area divided by the wetted perimeter
   c. Wetted perimeter divide by the area
   d. Square root of the area

3. In most of the economical rectangular sections of a channel, depth is kept equal to
   a. One- fourth of the width
   b. Three times the hydraulic radius
   c. Half the width
   d. Hydraulic mean depth

4. In a hydraulically most efficient trapezoidal channel section the hydraulic radius R is equal to
   a. y/2 b. y c. y/4 d. 6y

5. The phenomenon occurring in an open channel when a rapidly flowing stream abruptly changes to slowly flowing stream causing a distinct rise of
   a. Water hammer b. Hydraulic jump c. Critical discharge d. Specific energy

6. In parallel pipes
   a. The discharge is same in all pipes
   b. The head loss is same in all pipes
   c. The velocity is equal in all pipes
   d. The Hardy-Cross method is use

7. Identify the incorrect statement:
   a. Mild slope channels are M_1, M_2, and M_3
   b. Adverse slope channels are A_2 and A_3
   c. Horizontal channels are H_1 and H_3
   d. Critical slope channels are C_1 and C_3

8. The total number of possible types of GVF profiles are
   a. 9 b. 11 c. 12 d. 15

9. The direct step method of calculating the GVF profiles uses the relation
   a. $\Delta E = \Delta x\ (S_o - S_f)$
   b. $\Delta x = \Delta E / (S_o - S_f)$
   c. $\Delta x = \Delta E^* (S_o - S_f)$
   d. $\Delta y = \Delta x^* (S_o - S_f)/ (1-F^2)$

10. Piezometric head is the sum of
a. Pressure head, datum head, and velocity head b. Datum head and velocity head
c. Pressure head and velocity head d. Pressure head and datum head

11. In the uniform flow in a channel of small bed slope, the hydraulic grade line
a. Coincides with the bed
b. is considerably below the free surface
c. is considerably above the free surface
d. essentially coincides with the free surface

12. Rigid boundary channel is designed by
a. Method of economic section b. Method of tractive force
c. Alluvial soil regime approach d. Hardy cross method

13. Dimensions Shield's number, Cs is given by
a. $d/\zeta_o (\gamma_s - \gamma_w)$ b. $\zeta_o / d (\gamma_s - \gamma_w)$ c. $d(\gamma_s - \gamma_w) / \zeta_o$ d. $\zeta_o / d (\gamma_w - \gamma_s)$

14. The formation of channel bed due to flowing liquid is called .....
a. Bed load b. Wash load c. Suspended load d. Bed forms

15. The ratio of the inertia and viscous forces acting in any flow ignoring other forces is called
a. Euler number b. Froude number c. Reynolds number d. Weber number

16. Dynamic similarity between the model and the prototype is the
a. Similarity of motion b. Similarity of lengths
c. Similarity of forces d. Similarity of discharge

17. Under which of the following conditions the closure of valve is considered sudden
a. The duration of valve closure greater than 2L/C
b. The duration of valve closure is less than L/C
c. The duration of valve closure is less than 2L/C
d. The duration of valve closure is greater than 2C/L
Where L and C have their usual meanings.

18. For maximum discharge through a circular channel, the depth of flow should be equal to
a. 0.6 times the diameter of the channel b. 0.8 times the diameter of the channel
c. 0.95 times the diameter of the channel d. 1.2 times the diameter of the channel

19. The cross-section of a channel is said to be best, if the
a. Hydraulic mean depth is maximum
b. Section has the least perimeter for a given area
c. Roughness coefficient is maximum
d. Section gives maximum area for a given flow

20. In a hydraulic jump the energy loss is expressed as
a. $(y_2 - y_1)^2/4y_1.y_2$ b. $(y_2 - y_1)^3/4y_1.y_2$
c. $(y_2 - y_1)/4y_1.y_2$ d. $(y_2 - y_1)^{1/2}/4y_1.y_2$

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SECTION "B"

Make suitable assumptions wherever needed. The figures in the parenthesis indicate the marks allocated for the question.

1. Explain the terms distorted models and undistorted models. What is the use of distorted models? [3+1]

2. A Spillway model is to be built to a geometrically similar scale of 1/50 across a flume of 600mm width. The prototype is 15m high and maximum head on it is expected to be 1.5 m.
   a. What height of model and what head on the model should be used?
   b. If the flow over the model at a particular head is 12 l/s, what flow in prototype is expected? [3]

3. A most economical rectangular channel is to discharge water at the rate of 15cumecs with a velocity of 2.5 m/s. Design the channel if C = 70. [5]

   OR

   Water flows at 100 liter per second down in a rectangular flume of width 600 mm having adjustable bottom slope. If Chezy's constant C is 56, find the bottom slope necessary for uniform flow with a depth of flow of 300mm. Also find the conveyance K of the flume.

4. The discharge of water through a rectangular channel of width 8m is 15m^3/s when depth of flow of water is 1.2m.
   Calculate:
   i. Specific energy of flowing water ii. Critical depth and critical velocity
   iii. Value of minimum specific energy. [3]

5. A hydraulic pipe line is 3.8 km long and 40 cm in diameter is used to convey water with a velocity of 2m/s. Determine the pressure growth, if the valve provided at the outflow end is closed in (i) 20 seconds (ii) 3 seconds . Consider pipe to be rigid and take bulk of water k = $20*10^8$ N/m^2. [4]

6. A rectangular channel 8m wide carries a discharge of 11m^3/s (Manning's n = 0.025, bed slope of 0.0016). Compute the length of backwater profile created by a dam which backs up a depth 2m immediately behind the dam by Direct Step method. Take at least 3 steps to compute the profile. [7]

7. Design a rigid boundary irrigation channel laid on a slope of 0.0016 with a discharge 9.1 m^3/s. Assume Manning's n = 0.015 with permissible velocity 1.3 m/s. [5]

   OR

   Design a channel to carry a flow of 6.91 m^3/s. The channel has to be excavated through stiff clay with a longitudinal slope of 0.00318.

8. Write short notes on [*ANY THREE*] [3 × 3 = 9]
   a. Specific energy and Specific energy curve
   b. Pipes in series and parallel
   c. Flow types on the basis of critical depth/Froude's number
   d. Backwater curve and afflux
   e. Various kinds of bed forms