Registration no: | | | | | | | | | | |

Total Number of Pages: 02

B.TECH
PECI 5401

4th Year Special Examination – 2015-16
WATER RESOUCES ENGINEERING
BRANCH: CIVIL ENGINEERING

Time: 3 Hours
Max marks: 70
Q. CODE: X225

Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

Q1 Answer the following questions: (2 x 10)

a) Name different methods of determining average rainfall in a particular catchment area.

b) What is the function of current meter?

c) What do you mean by synthetic unit hydrograph?

d) Differentiate between ϕ index and W index.

e) What is design flood?

f) Differentiate between stream flow and runoff.

g) If the conjugate depths before and after the jump are 2 m and 3 m respectively, then the loss of energy in the hydraulic jump will be.

h) What is critical flow in a open channel?

i) What is the function of breakwaters?

j) What are the requirements of a commercial harbor?

Q2 a) Describe the principle of working of a weighing bucket type recording raingauge with a neat sketch. What are its advantages and disadvantages? (6)

b) Define pan coefficient. Discuss the relative merits and demerits of sunken, floating and land pans. (4)

Q3 a) Define catchment. Explain how the catchment boundary can be obtained from the topographic maps. (5)

b) Describe the principle involved in the measurement of stream flow by dilution method. What are the requisites of a good tracer used in the dilution method. (5)

Q4 The ordinates of a 4 h U.H. of a basin of area 200 Km^2 measured at 1 h intervals are 6, 36, 66, 91, 106, 93, 79, 68, 58, 49,41,34,27, 23, 17, 13, 9, 6, 3 and 1.5 m^3/s respectively. Obtain the ordinates of a 3 h U.H. for the basin using the S-curve technique. (10)

Q5 a) Derive the Muskingum routing equation and the expressions for the routing coefficients C_0, C_1 and C_2. (5)

b) Write a brief note on frequency factor and its estimation in Gumbel's distribution. (5)

Q6 a) What are the assumptions for Gradually Varied Flow? Give two examples and Derive the equation for GVF. (6)

b) An earthen channel with a base width 6 m and side slope 1H: 2V carries water with a depth of 1.5 m. the bed slope is 1 in 1000. Calculate the discharge if η = 0.03. Also calculate the average shear stress at the channel boundary. (4)

7 a) What information should be collected and rules to be observed in the design of a breakwater. (5)

b) Define Wharf, quay, pier, jetty and fender. (5)

8 Write short notes on any two of the followings (5 x 2)

a) Stage discharge curve
b) Instantaneous unit hydroghaph
c) Most efficient trapezoidal channel section
d) Specific Energy diagram

B. Tech
PECI 5401

Fourth Year Special Examination – 2014-15

WATER RESOURCE ENGINEERING

BRANCH : CIVIL

QUESTION CODE : N 576

Full Marks – 70

Time : 3 Hours

*Answer Question No. **1** which is compulsory and any **five** from the rest.*
The figures in the right-hand margin indicate marks.

1. Answer the following questions : 2 ×10
   (a) Define catchment and topographic devide.
   (b) Define frequency factor and its estimation in Gumbel's method.
   (c) What is the principle involved in measurement of stream flow by the dilution method ?
   (d) What are the factors affecting infiltration ?
   (e) Sketch a typical hydrograph resulting from an isolated storm and identify the features of the same.
   (f) Name different methods for estimating design flood.
   (g) What is critical flow in a open channel ?
   (h) Sketch the possible water surface profiles for Mild slope followed by milder slope and steep slope.
   (i) What are the function of jetties ?
   (j) What are the requirements of a commercial harbor.
2. (a) Describe the principle of working of a tipping bucket type recording rain gauge with a neat sketch. Mention its advantages and disadvantages. 7
   (b) A major river basin is divided into four sub basins with areas of 920, 705, 1075 and 1665 km^2. If the average annual rainfall on these sub basins is 73, 85, 112 and 100 cm respectively. What is the average annual rainfall for the basin as a whole ? 3
3. (a) Define pan coefficient. Discuss the relative merits and demerits of sunken, floating and land pans. 5

P.T.O.

(b) Explain the procedure for obtaining the stage-discharge relationship of a stream by using the stage-discharge data from a site with permanent control. 5

4. (a) The direct runoff hydrograph resulting from a 5.0 cm of effective rainfall of 6 h duration is given below. Determine the area of the catchment and the ordinates of the 6 h unit hydrograph. 8

Time (h)	0	6	12	18	24	30	36	42	48	54	60	66	72
Direct runoff (cumecs)	0	25	175	320	360	310	230	165	105	60	30	10	0

(b) What do you understand by synthetic unit hydrograph. 2

5. (a) Describe the Modified Puls method of reservoir routing. 5

(b) Explain the method of determining the Muskingham parameters K and x of a reach from a pair of observed inflow and outflow hydrographs. 5

6. (a) Show that a trapezoidal channel section with given A and y is most efficient when its sides are inclined at 60° with the horizontal. 3

(b) A 3.0 m wide rectangular channel carries 2.4 m^3/s discharges at a depth of 0.70 m. 7

(i) Determine specific energy at 0.70 m depth.

(ii) Determine the critical depth.

(iii) Is the flow subcritical of supercritical ?

(iv) Determine the depth alternate to 0.70 m

(v) If Mannings n is 0.015, determine the critical slope.

7. (a) Describe the barge method of mound construction. 5

(b) What are the design considerations of a floating dock. Mention advantages and disadvantages of floating dock. 5

8. Write short notes on any **two** of the followings : 5×2

(a) Φ -index

(b) S curve hydroghaph

(c) Hydraulic Jump

(d) River training works.

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B. Tech

PECI5401

Seventh Semester Examination – 2013

WATER RESOURCES ENGINEERING

BRANCH : CIVIL

QUESTION CODE : C-295

Full Marks – 70

Time : 3 Hours

*Answer Question No. **1** which is compulsory and any **five** from the rest.*
The figures in the right-hand margin indicate marks.

1. Answer the following questions : 2×10
   (a) What do you mean by watershed ?
   (b) What are the precautions to be taken in selecting a site for the location of a rain gauge ?
   (c) What is infiltration capacity ?
   (d) If two 4 hour unit hydrographs are staggered by 4 hours and added graphically the resulting hydrograph will be what ?
   (e) What is the probability of a 10 year flood to occur at least once in the next 4 year ?
   (f) Differentiate between reservoir routing and channel routing.
   (g) What is specific energy diagram ?
   (h) What is the critical depth of flow in a most economical triangular channel section for a discharge of 1 m^3/s ?
   (i) An open channel carries water with a velocity of 0.605 m/s. If the average bed shear stress is 1.0 N/m^2, find the Chezy coefficient C.
   (j) What are the functions of jetties ?
2. (a) Describe with neat sketch the principle of working of Symon's non-recording raingauge. How does the Indian standard rain gauge differ from Symon's gauge ? 5
   (b) Describe evapotranspiration. Explain different methods to reduce evaporation losses. 5

P.T.O.

3. (a) Explain the salient features of a current meter. Describe briefly the procedure of using a current meter for measuring velocity in a stream. 5

(b) Define Φ index and W index and bring out the difference between them. How is Φ index determined from the rainfall hyetograph ? 5

4. The ordinates of a flood hydrograph, resulting from two successive storms each of 1 cm rainfall excess and 3 hour duration, are tabulated below. Find a 6 hour unit hydrograph. 10

Time (hour)	0	6	12	18	24	30	36	42	48	54	60
Ordinate of 6 hr unit hydrograph (m^3/s)	10	30	90	220	280	220	166	126	92	62	40

5. (a) The mean annual flood of a river is 500 m^3/s and the standard deviation of the annual flood time series is 100 m^3/s. What is the probability of a flood of magnitude 1000 m^3/s occurring in the river within next 6 years. Use Gumbel's method and assume the sample size to be very large. 5

(b) What is flood routing ? Explain the basic equations used for flood routing. 5

6. (a) A rectangular channel 8 m wide has a depth of water 4 m. If the slope of the bed of the channel is 1 in 3000, find the discharge through the channel. Take the value of n = 0.027 in the Kutter's formula. 5

(b) What do you mean by hydraulic jump in open channel flow ? If the conjugate depths before and after the jump are 1 m and 3 m respectively, then find the loss of energy in the hydraulic jump. 5

7. (a) Explain with neat sketches how mound breakwaters are protected from wave action. 5

(b) Enumerate the principal forces acting on a graving dock. 5

8. Write short notes on any **two** of the following : 5×2

(a) Pan evaporation

(b) River training works

(c) Instantaneous Unit Hydrograph

(d) Most efficient trapezoidal channel section.

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B. Tech

PECI5401

Seventh Semester (Special) Examination – 2013

WATER RESOURCES ENGINEERING

BRANCH : CIVIL

QUESTION CODE : D 407

Full Marks – 70

Time : 3 Hours

*Answer Question No. **1** which is compulsory and any **five** from the rest.*

The figures in the right-hand margin indicate marks.

1. Answer the following questions : 2×10

(a) Define *evapotranspiration.*

(b) What are the precautions to be taken in selecting a site for the location of a rain gauge ?

(c) What is the average pan coefficient for the standard US weather Bureau class A pan ?

(d) Explain the rainfall intensity, duration and frequency relationship.

(e) What is a unit hydrograph ?

(f) What is the probability that a hundred year flood may not occur at all during the 50 year life of a project ?

g) What is specific energy ?

h) Write Kutter's equation.

i) What are the functions of jetties ?

j) What are the factors affecting the selection of site for a harbor ?

2. (a) Describe classification of catchment. How would you work out run off at the outlet of a catchment resulting from rainfall over it ? 5

(b) Determine □ index and W index for a watershed with an area of 100 km^2. A rainfall with the specifications given in the following table occurred in the watershed. The average flow measured at the outlet of the watershed was 100 m^3/s. Assume the retention to be 10% of rainfall. 5

Time (min)	Intensity (cm/hr)
0-30	0.300
60-120	1.205
120-150	1.500

3. (a) Explain the different methods of determining the average rainfall over a catchment due o a storm. 4

(b) Following velocities were recorded in a stream by means of current meter. If the depth of flow at the point is 6 m and the width of section is 3.0 m, determine the discharge. 6

Depth above bed in m	0	0.75	1.0	1.2	2.0	3.0	4.8	5.0
Velocity in m/s	0	0.4	0.6	0.65	0.75	0.85	1.0	1.2

4. (a) What is an IUH ? What are its characteristics ? 5

(b) Describe the S curve method of developming a 6-h Unit Hydrograph using 12-h UH of the catchment. 5

5. (a) Differentiate between reservoir routing and channel routing. 3

(b) Route the following hydrograph through a river reach for which K =22.0 hr and x= 0.25. At the start of the inflow flood, the outflow discharge is 40 m^3/s. 7

Time (hr)	0	12	24	36
Inflow (m^3/s)	40	65	165	250

6. (a) What are the assumptions for GVF ? Derive the equation for GVF. 5

(b) A hydraulic jump is formed in a 5 m wide rectangular channel carrying a discharge of 20 m^3/s. The pre jump depth is 0.5 m. Find the post jump depth, post jump Froude number, and energy loss in the jump. 5

7. (a) Distinguish between natural and artificial harbours. Explain how an artificial harbor could be made to provide safe anchorage. 5

(b) State the precautions necessary in the design and construction of upright wall breakwaters to withstand the effects of the destructive forces acting on them. 5

8. Write short notes on any **two** of the following : 5×2

(a) Symon's rain gauge

(b) River traing works

(c) Most efficient circular channel section.

B.Tech
PECI 5401

Seventh Semester Examinations – 2012-13
WATER RESOURCES ENGINEERING
Full Marks : 70
Time : 3 Hours

Answer six questions including question No.1 which is compulsory
Figures in the right hand margin indicate marks

1. Answer the followings /2*10
   a. How many rain gauge stations are necessary to measure the mean rainfall with certain predefined error?
   b. What is double mass curve?
   c. Why moving average of any time series data is carried out?
   d. How probability of occurrence and return period of a variable related?
   e. Why the pan coefficients of various evaporimeters differ?
   f. Differentiate perennial and ephemeral stream.
   g. How shape of the catchment affects shape of the hydrograph?
   h. What is physical sense of specific duration of an unit hydrograph?
   i. What is linear reservoir?
   j. What is the philosophy of most economical section?

2. a) Explain the procedure of filling the missing data of a time series. /5
   b) Compare the thissen-polygon and isohyetal method of finding the mean rainfall. /5

3. a) Explain various types of infiltrometers. Discuss the advantages of one type of infiltrometer over the other. /5
   b) Explain the equipments used for measurement of velocity. /5

4. The mass curve of an isolated storm in a 500 ha watershed is as follows:

Time from start (Hr)	0	2	4	6	8	10	12	14	16	18
Cumulative rainfall (cm)	0	0.8	2.6	2.8	4.1	7.3	10.8	11.8	12.4	12.6

If the direct runoff produced by the storm is measured at the outlet of the watershed as 0.34 Mm^3, estimate the φ-index of the storm and duration of rainfall excess. /10

5. The ordinates of a 6-h unit hydrograph are given below:

Time (hr)	0	6	12	18	24	30	36	42	48	54	60	66
Ordinate of 6-h UH (m^3/s)	0	250	600	800	700	600	450	320	200	100	50	0

A storm had three successive 6-h intervals of rainfall magnitude of 3.0, 5.0 and 4.0 cm respectively. Assuming a φ-index of 0.20 cm/h and a base flow of 30 m^3/s, determine the resulting hydrograph of flow. /10

6. Using the ordinates of a 12-h unit hydrograph given below, compute the ordinates of the 6-h unit hydrograph of the basin.

Time (Hour)	Ordinate of 12-h unit hydrograph (m^3/sec)	Time (Hour)	Ordinate of 12-h unit hydrograph (m^3/sec)
0	0	42	58
6	37	48	35
12	111	54	17
18	150	60	8
24	146	66	3
30	114	72	0
36	84		

/10

7. Route the following flood hydrograph through the river reach for which Muskingum coefficient K=8 hours and x = 0.25.

Time (hr)	0	4	8	12	16	20	24	28
Inflow (m^3/s)	8	16	30	30	25	20	15	10

The initial outflow discharge from the reach is 8.0 m^3/s. /10

8. a) Explain hydraulic jump by the help of specific energy curve. /5

b) Explain wall type breakwater with a cross sectional view. /5

B.Tech
PECI 5401

Seventh Semester Examinations – 2012-13
WATER RESOURCES ENGINEERING
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2. a) Explain the procedure of filling the missing data of a time series. /5
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Cumulative rainfall (cm)	0	0.8	2.6	2.8	4.1	7.3	10.8	11.8	12.4	12.6

If the direct runoff produced by the storm is measured at the outlet of the watershed as 0.34 Mm^3, estimate the φ-index of the storm and duration of rainfall excess. /10

5. The ordinates of a 6-h unit hydrograph are given below:

Time (hr)	0	6	12	18	24	30	36	42	48	54	60	66
Ordinate of 6-h UH (m^3/s)	0	250	600	800	700	600	450	320	200	100	50	0

A storm had three successive 6-h intervals of rainfall magnitude of 3.0, 5.0 and 4.0 cm respectively. Assuming a φ-index of 0.20 cm/h and a base flow of 30 m^3/s, determine the resulting hydrograph of flow. /10

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36	84		

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Time (hr)	0	4	8	12	16	20	24	28
Inflow (m^3/s)	8	16	30	30	25	20	15	10

The initial outflow discharge from the reach is 8.0 m^3/s. /10

8. a) Explain hydraulic jump by the help of specific energy curve. /5

b) Explain wall type breakwater with a cross sectional view. /5