

**INSTITUTE OF AERONAUTICAL ENGINEERING****(Autonomous)****Dundigal, Hyderabad - 500 043****MODEL QUESTION PAPER**

B.Tech VI Semester End Examinations (Regular), May- 2020

**Regulations: R16****WATER RESOURCES ENGINEERING**

(Civil Engineering)

**Time: 3 hours****Max. Marks: 70**

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the question must be answered in one place only

**UNIT – I**

1. a) Explain step by step procedure you would adopt to prepare the depth- area duration curves for a particular storm for a basin having a number of rain- gauges, most of which are recording. [7M]

- b) An outlet is to be designed for a town covering 25 km<sup>2</sup>, of which road area is 30%, residential area 40% and rest industrial area. The slope of the catchment is 0.004 and maximum length of the town measured in map is 3 km. From depth duration analysis the following information is obtained.

Rainfall Duration(min)	30	45	60
Rainfall Depth(mm)	15	20	30

[7M]

Calculate the peak discharge. When The coefficient for road is 0.80, residential area is 0.40 and industrial area is 0.20.

2. a) Explain the following in brief.  
(i) Probable maximum precipitation  
(ii) Rain gauge density.  
(iii) Various types of precipitation [7M]

- b) A basin has the area in the form of a pentagon with each side of length 20Km. The five rain gauges located at the corners A, B, C, D and E have recorded 60, 81, 73, 59 and 45 mm of rainfall respectively. Compute average depth of rainfall over the basin using arithmetic mean and Thiessen polygon methods. What are the various components of runoff? Describe how each component is derived in the runoff process. [7M]

**UNIT – II**

3. a) What are the various components of runoff? Describe how each component is derived in the runoff process. [7M]

- b) A drainage basin has the following characteristics. Basin area = 2500 sq. km. Length of the main stream L = 110 km Distance from the centroid of the basin to outlet = 70 km. Constructs the 4 hour synthetic unit hydrograph for the basin if  $C_t = 1.50$  and  $C_p = 0.6$  [7M]

4. a) What is Hydrograph? And the applications of unit hydrograph. Draw a single peaked hydrograph and explain its components harvesting? [7M]

4. b) The ordinates of a 4-hour unit hydrograph are given below. Derive the ordinates of an 8-hour unit hydrograph by the S-curve method

Time (hr) 4 hr UGO(Cumec)	Time (hr) 4 hr UGO(Cumec)	Time (hr) 4 hr UGO(Cumec)	Time (hr) 4 hr UGO(Cumec)
0	0	24	103
4	24	28	64
8	84	32	36
12	159	36	17
16	184	40	6
20	151	44	0

[7M]

### UNIT – III

5. a) Difference between  
 (a) Specific capacity of a well and Specific yield of an aquifer  
 (b) Aquifer and Aquiclude [7M]
- b) A 20 cm well penetrates 30 m below static water level. After a long period of pumping at a rate of 1800 lpm, the drawdowns in the observation wells at 12 m and 36 m from the pumped well are 1.2 m and 0.5 m respectively. Determine the  
 i. Transmissibility of the aquifer. [7M]  
 ii Drawdown in the pumped well assuming radius of influence as 300m.  
 iii. Specific capacity of the well.
6. a) Draw neat sketches of confined and unconfined aquifers. How one is different from each other. [7M]
- b) A well with a radius of 0.5m penetrates completely a confined aquifer of thickness 40 m and permeability 30m /day. The well is pumped so that the water level in the well remains at 7.5m below the original piezometric surface. Assuming that the radius of influence is 500m compute the steady state discharge from the well [7M]

### UNIT – IV

7. a) Discuss various methods of irrigation and state the advantages of each method? [7M]
- b) Determine the storage capacity of soil from the following data: Field Capacity = 30%  
 Wilting point = 14% Depth of Root zone = 1.20 m Dry Unit weight of soil = 1.7 g/cc  
 Also determine the depth of water required in the field if irrigation water is supplied when the moisture content falls to 20% and the field application efficiency is 80%. If the conveyance losses in the water courses and field channels are 16% of the outlet discharge, calculate the depth of water needed at the canal outlet. [7M]
8. a) What is meant by duty and delta of canal water? Derive a relation between duty and delta for a given base period. [7M]
- b) The command cultivated area for a distributary is 15000 ha. The intensity of irrigation is 40% for rabi and 10% for rice. If kor period is 4 weeks for rabi and 2.5 weeks for rice, determine the outlet discharge. Outlet factor for rabi and rice may be assumed as 1800 ha /m<sup>3</sup> / sec and 775 ha /m<sup>3</sup> / sec. What is design discharge of distributary head at 10% conveyance. [7M]

## UNIT – V

9. a) Distinguish between:
- i. Overland flow and interflow [7M]
  - ii. Influent and effluent streams
- b) Design a channel section by Kennedy's theory given the following data:  
Discharge  $Q = 2828$  cumecs. Kutter's  $N = 0.0225$  Critical velocity ratio ' $m$ ' = 1,  
Side slope = 0.5:1,  $B/D = 7.6$  Find also the bed slope of the channel. [7M]
10. a) Write down the classification of canals. Explain canal alignment [7M]
- b) Using Lacey's theory, design an irrigation channel for the following data.  
Discharge  $Q = 50$  cumecs  
Silt factor ' $f$ ' = 1.0, [7M]  
Side slopes: 1/2 : 1



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## COURSE OBJECTIVES:

The course should enable the students to:

I	Enrich the knowledge of hydrology that deals with the occurrence, distribution and movement of water on the earth.
II	Design unlined and lined irrigation canals; mitigate sediment problems associated with canal.
III	Identifying, formulating and management of water resource related issues.
IV	Discuss the limitations and applications of hydrograph flood analysis

## COURSE OUTCOMES (COs):

CO 1	Understand the basic knowledge of hydrology, hydrological cycle, precipitation and movement of water on earth and below the earth surface in addition to importance and estimation of runoff.
CO 2	Determining the importance of different types of hydrographs.
CO 3	Importance and occurrence of Ground water, estimation of discharge through various types of aquifers, wells development.
CO 4	Analyze the importance of irrigation and their types, methods of application of irrigation water, duty and delta, irrigation efficiencies, water logging.
CO 5	Understand the classification of canals, design of irrigation canals, IS standards for a canal design canal lining, SCS curve number method, flood frequency analysis of stream flow.

## COURSE LEARNING OUTCOMES (CLOs):

ACE014.01	Understand the basic concepts of Hydrology and its applications. And also understand different forms and types of precipitation..
ACE014.02	Understand the Rainfall measurement methods and different types of Rain gauges
ACE014.03	Compute the average rainfall over a basin, processing of rainfall data, and adjustment of rainfall record and usage of double mass curve.
ACE014.04	Understand the concepts of runoff, factors affecting runoff, runoff over a catchment, empirical and rational formulae.
ACE014.05	Understand the abstraction from rainfall, evaporation, factors affecting evaporation, measurement of evaporation, evapo-transpiration, penman and Blaney- Criddle methods and infiltration.
ACE014.06	Understand the concept of Hydrograph, effective rainfall, and base flow separation
ACE014.07	Analyze the concept of direct runoff hydrograph
ACE014.08	Analyze the importance of unit hydrograph, definition and limitations applications of unit hydrograph.
ACE014.09	Understand the derivation of unit hydrograph from direct runoff hydrograph and runoff hydrograph to unit hydrograph
ACE014.10	Understand the concept of synthetic unit hydrograph and its applications.
ACE014.11	Understand the Ground water Occurrence and types of aquifers
ACE014.12	Define and understand the different terminology of water resource engineering like aquifer parameters, porosity, specific yield, permeability, and Transmissivity.
ACE014.13	Determine the radial flow to wells in confined and unconfined aquifers
ACE014.14	Understand the concept of Darcy's law in aquifers
ACE014.15	Understand the Types of wells, well construction, and well development.

ACE014.16	Understand the work necessity and importance of irrigation, advantages and ill effects of irrigation, types of irrigation
ACE014.17	Explain the methods of application of irrigation water and understand the India agricultural soils, methods of improving soil fertility, crop rotation, and preparation of land for irrigation
ACE014.18	Understand the standards of quality for irrigation water, soil, water, plant relationship, vertical distribution of soil moisture, soil moisture constants.
ACE014.19	Calculate the soil moisture tension, consumptive use, duty and delta and understand the factors affecting duty.
ACE014.20	Determination of design discharge for a water course. Depth and frequency of irrigation, irrigation efficiencies, water logging
ACE014.21	Understand the mechanical classification of canals
ACE014.22	Design of irrigation canals by Kennedy's and Lacey's theories, balancing depth of cutting
ACE014.23	Calculate by using IS standards for a canal design canal lining and design discharge over a catchment, computation of design discharge, rational formula.
ACE014.24	Understand the SCS curve number method and flood frequency analysis of stream flow.

### MAPPING OF SEMESTER END EXAMINATION - COURSE OUTCOMES

SEE Question No	Course Learning Outcomes		Course Outcomes	Blooms Taxonomy Level	
1	a	ACE014.02	Understand the Rainfall measurement methods and different types of Rain gauges	CO 1	Understand
	b	ACE014.03	Compute the average rainfall over a basin, processing of rainfall data, and adjustment of rainfall record and usage of double mass curve.	CO 1	Remember
2	a	ACE014.01	Understand the basic concepts of Hydrology and its applications. And also understand different forms and types of precipitation.	CO 1	Understand
	b	ACE014.04	Understand the concepts of runoff, factors affecting runoff, runoff over a catchment, empirical and rational formulae.	CO 1	Remember
3	a	ACE014.07	Analyze the concept of direct runoff hydrograph	CO 2	Understand
	b	ACE014.08	Analyze the importance of unit hydrograph, definition and limitations applications of unit hydrograph.	CO 2	Remember
4	a	ACE014.06	Understand the concept of Hydrograph, effective rainfall, and base flow separation	CO 2	Understand
	b	ACE014.10	Understand the concept of synthetic unit hydrograph and its applications.	CO 2	Remember
5	a	ACE014.11	Understand the Ground water Occurrence and types of aquifers	CO 3	Understand
	b	ACE014.12	Define and understand the different terminology of water resource engineering like aquifer parameters, porosity, specific yield, permeability, and Transmissivity.	CO 3	Remember
6	a	ACE014.13	Determine the radial flow to wells in confined and unconfined aquifers	CO 3	Understand
	b	ACE014.13	Determine the radial flow to wells in confined and unconfined aquifers	CO 3	Remember
7	a	ACE014.16	Understand the work necessity and importance of irrigation, advantages and ill effects of irrigation, types of irrigation	CO 4	Understand
	b	ACE014.17	Explain the methods of application of irrigation water and understand the India agricultural soils, methods of improving soil fertility, crop rotation, and preparation of land for irrigation	CO 4	Remember

8	a	ACE014.19	Calculate the soil moisture tension, consumptive use, duty and delta and understand the factors affecting duty.	CO 4	Understand
	b	ACE014.20	Determination of design discharge for a water course. Depth and frequency of irrigation, irrigation efficiencies, water logging	CO 4	Remember
9	a	ACE014.21	Understand the mechanical classification of canals	CO 5	Understand
	b	ACE014.22	Design of irrigation canals by Kennedy's and Lacey's theories, balancing depth of cutting	CO 5	Remember
10	a	ACE014.21	Understand the mechanical classification of canals	CO 5	Understand
	b	ACE014.22	Design of irrigation canals by Kennedy's and Lacey's theories, balancing depth of cutting	CO 5	Remember

**Signature of Course Coordinator**

**HOD, CE**