GUJARAT TECHNOLOGICAL UNIVERSITY
BE SEM-V Examination-Nov/Dec.-2011

Subject code: 150602   **Date: 24/11/2011**
Subject Name: Hydrology and Water Resources Engineering
                                                Time: 2.30 pm -5.00 pm
                                                Total marks: 70

Instructions:
1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Explain 'Drought'. Distinguish between hydrological drought and meteorological drought. Describe, in detail, measures for water conservation and augmentation of water resources. **07**

(b) Discuss the objectives of water resources development and also, explain the environmental aspects in water resources planning. **07**

Q.2 **(a)** Explain structural and non-structural approaches of controlling damage due to floods. **07**

(b) (i)Explain, clearly, 'design flood' and 'time of concentration'. **02**
(ii)For a river, the estimated flood peaks for two return periods by the use of Gumbel's method are as follows: **05**

Return period (years)	Peak flood (m^3/s)
100	435
50	395

What flood discharge in this river will have a return period of 1000 years?

OR

(b) (i)Explain 'Flood routing'. Discuss, in brief, reservoir routing and channel routing. **03**
(ii)Route the following flood, using Muskingum method, through a reach for which k=22 hr and x=0.25. **04**

Time (hr)	0	12	24	36	48	60	72
Discharge (m^3/s)	40	65	165	250	240	205	170

Time (hr)	84	96	108	120	132	144
Discharge (m^3/s)	130	115	85	70	60	54

The outflow discharge is 40 m^3/s at time t=0. Also, determine the peak lag and attenuation.

Q.3 (a) (i)Enlist different types of rain gauges and explain the use of a non-recording **04** rain gauge in the measurement of rainfall.

(ii)For a drainage basin of 600km^2, isohyets drawn for a storm gave the **03** following data:

Isohyets (cm)	40	35	30	25	20	15	10
Catchment area enclosed (km^2)	--	35	90	150	310	430	600

Estimate the average depth of precipitation over the basin.

(b) Annual rainfall for the station X as well the average annual rainfall measured **07** at 20 base stations located in a meteorologically homogeneous region are given below:

Year	1946	'47	'48	'49	'50	'51	'52	'53	'54	'55	'56
Rainfall at stn. X (cm)	120	153	172	127	108	126	190	112	97	86	111
Rainfall at 20 base stn. (cm)	90	138	119	108	107	111	142	112	99	93	131

Year	1957	'58	'59	'60	'61	'62	'63	'64	'65	'66
Rainfall at stn. X (cm)	68	88	112	95	106	81	116	112	80	88
Rainfall at 20 base stn. (cm)	92	142	123	142	92	91	131	104	97	111

Test the consistency of 21 years of data of the annual rainfall measured at station X. Using double mass curve, adjust the recorded data at station X and determine mean annual precipitation.

OR

Q.3 (a) (i)Explain 'Evapotranspiration'. Enlist different methods of measurement of **04** evapotranspiration and describe any one of them.

(ii)The average rainfall over a basin of area 50 ha during a storm was as **03** follows:

Time (hr)	0	1	2	3	4	5	6	7
Rainfall (cm)	0	6	11	34	28	12	6	0

If the volume of runoff from this storm was measured as 25000 m^3, determine the φ-index for the storm.

(b) Results to determine Horton's infiltration capacity (f_{ct}) in the exponential form **07** are tabulated below:

Time (hr)	0.25	0.5	0.75	1.0	1.25	1.5	1.75	2.0
f_{ct} (cm/hr)	5.60	3.20	2.10	1.50	1.20	1.10	1.0	1.0

Determine the infiltration capacity exponential equation.

Q.4 (a) (i)What is hydrograph? Sketch a typical flood hydrograph for a catchment and **04** show different components of the hydrograph. List the factors affecting the shape of the hydrograph.

(ii)A 12-hr Unit hydrograph (UH) of a catchment is triangular in shape with a **03** base width of 144 hr and peak discharge of 23 m^3/s. Calculate the area of the catchment.

(b) Explain, with a neat sketch, occurrence of ground water at various locations **07** below earth surface. Also, explain clearly, artesian well, confined aquifer, permeability and specific yield.

OR

Q.4 **(a)** Define 'Unit hydrograph'. What are the assumptions in Unit hydrograph **07**
theory?
A 6-hr UH for a basin has the following ordinates:

Time (hr)	0	6	12	18	24	30	36	42	48	54	60	66
Ordinates of 6-hr UH (m^3/s)	0	20	60	150	120	90	66	50	32	22	10	0

Determine the ordinates of 12-hr UH, using S-curve method.
(b) (i)Describe a method of determining the yield from an open well. **03**
(ii)A fully penetrating well of dia. 0.3m draws water from a confined aquifer of **04**
permeability .001 m/s and thickness 15 m. If steady state discharge is found to
be 1/30 m3/s, compute the drawdown at points 10 m 1nd 40 m from the centre
of the well. Take radius of influence of well 1000 m.

Q.5 **(a)** Giving detailed classification of reservoirs; explain the importance of **07**
distribution reservoir in water supply scheme. Discuss, in detail, different
zones of storage in a reservoir and explain, with a neat sketch, density current.
(b) (i)Define trap efficiency. Explain different methods of control of reservoir **04**
sedimentation.
(ii)In context of hydroelectric power, define the following terms: **03**
Firm power, Installed capacity, Plant factor.

OR

Q.5 **(a)** The monthly run-off volume (in Mm^3) for a period of two water years recorded **07**
at a stream gauging site are 3, 6, 16, 30, 18, 15, 10, 8, 6, 4, 3, 1, 2, 5, 17, 28,
20, 15, 12, 7, 5, 4, 3 and 2. Determine the size of the reservoir proposed at the
gauging site, if is to maintain an assured supply of 8.33 Mm^3/month. The water
year may be taken as June to May and assume each month of 30 days.
If the reservoir is half-full at the beginning of the year, locate the periods
of excess flow and depletion in the reservoir.
(b) (i)Give detailed classification of hydro power plants and explain, clearly, low, **04**
medium and high head plants.
(ii)Discuss the relative merits and demerits of hydro power units as compared **03**
to other power sources.

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