Introduction to Hydraulic Structures

Design of Hydraulic Structures (CVL381)

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Evaluation Policy

Categories	Weightage
Minor Examination	30%
Major Examination	40%
Quiz, Assignment & Design Problems	30%
Total	**100%**

Attendance Policy:

- ✓ Lecture attendance will not be considered in the final evaluation.
- ✓ Sessional class attendance will be taken into consideration for the final evaluation.
- ✓ Mass bunks without prior intimation for rescheduling will be dealt strictly.
- ✓ The topics discussed in the lecture classes will not be rediscussed in the sessional classes. **Students not attending the lecture classes should go through the topics by themselves and come prepared for the sessional classes.**
- ✓ Abide by the **Honor Code of IIT Delhi**.

Text Books

- ✓ **Irrigation Engineering and Hydraulic Structures** by ***Santosh Kumar Garg***.
- ✓ **Theory & Design of Irrigation Structures - Volume II (Canal and Storage Works)** by ***R. S. Varshney, S. C. Gupta and R. L. Gupta***.
- ✓ **Irrigation and Water Power Engineering** by ***Dr. B. C. Punmia and Dr. Pande B. B. Lal***.
- ✓ **Irrigation and Water Resources Engineering** by ***G. L. Asawa***.

What is a Hydraulic Structure?

A hydraulic structure is a man-made structure constructed to store natural water or tame (divert, disrupt, or completely stop) the natural flow of water resources.

Common Examples of Hydraulic Structures:

- ✓ ***Dams***
- ✓ ***Weirs or barrages***
- ✓ ***Reservoirs***
- ✓ ***Canals***
- ✓ ***Wells***

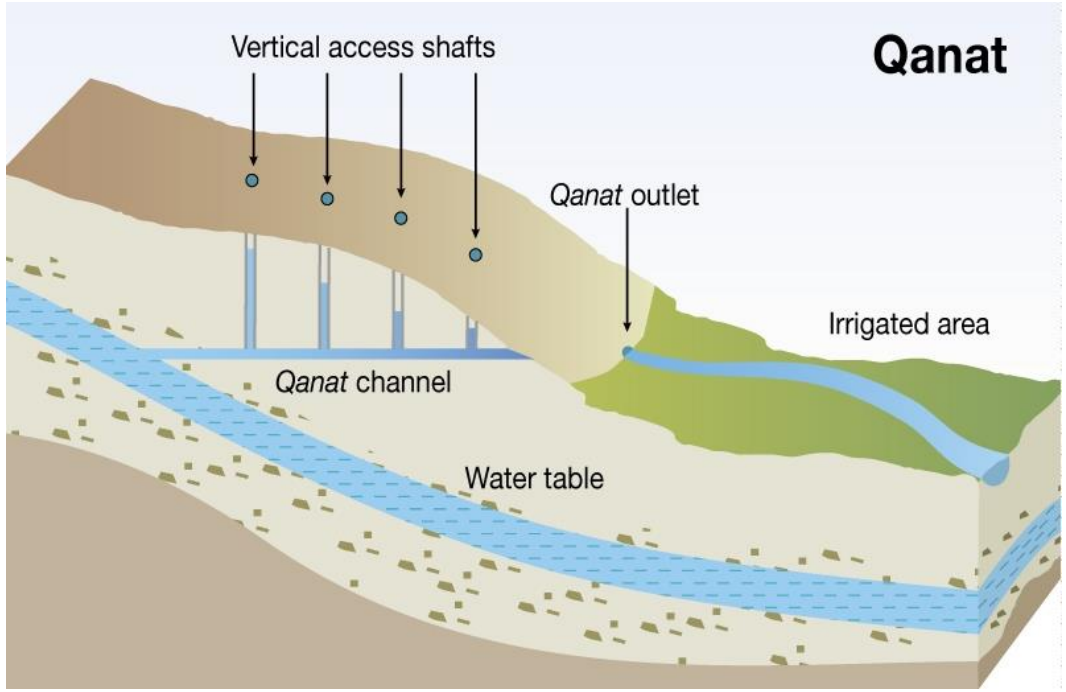
Qanats of Ancient Iran

Qanat is a hydraulic system originated approximately 3,000 years ago in the Persian desert for transporting water from an aquifer or water well to the surface, through an underground **aqueduct**.

What is the historical significance of Qanats?

How were the Qanats constructed?

Aqueduct: A watercourse constructed to carry water from a source to a distribution point far away.



Photograph Source: http://maps.grida.no/go/graphic/qanat

World's First Dam – Jawa Dam

- Jawa, a Bronze Age city, was protected from flash floods using dams, including a masonry gravity dam that is not only the largest but also the oldest known dam worldwide.
- Located in today's Jordan, the Jawa Dam was originally constructed around 3,000 BC in ancient Mesopotamia.

Photograph Source: https://flowtraveljo.com/blog/

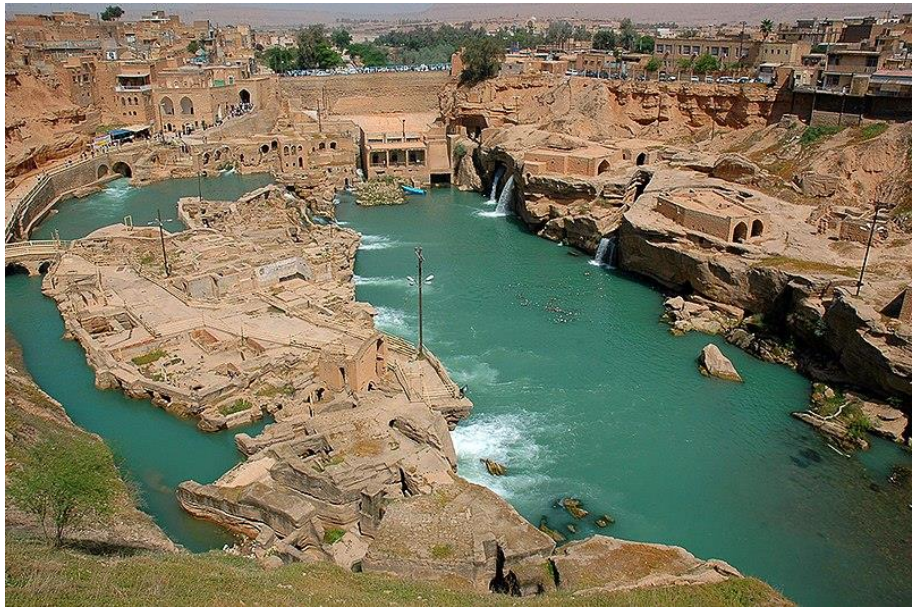
Sushtar Historical Hydraulic System

Shushtar Historical Hydraulic System, inscribed as a masterpiece of creative genius, can be traced back to the 5th century B.C.

[A small Documentary on Shushtar Hydraulic System]

How does the Shushtar Historical Hydraulic System work?

First, Gargar Dam blocks the water flow of the Karun river and the water rises up behind the dam. There are three tunnels that drive the water into the main complex and divide them into several channels which make the mills turning. After this, the water pours like a waterfall inside a pool.

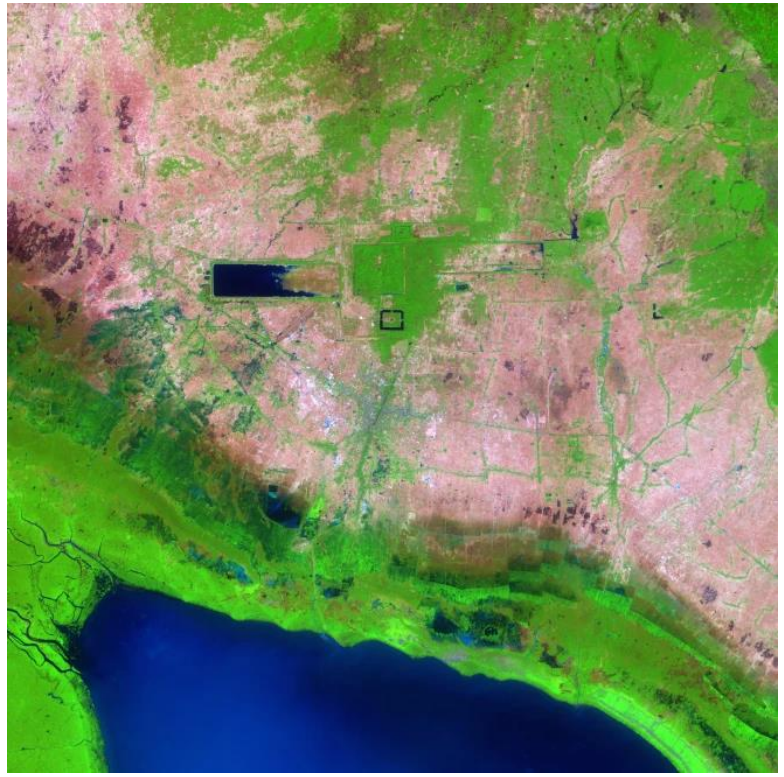


Photograph Source: https://en.wikipedia.org/wiki/Shushtar_Historical_Hydraulic_System

Water Technologies of the Khmer Civilization (802-1327 AD) - Angkor, Cambodia

- Angkor has been referred to as the world's first mega city and a hydraulic city.
- In 2012, the true extent of the hydraulic system, which spans 1,000 sq km (size of present day New York city), was revealed through airborne laser scanning technology (LiDAR) led by archaeologist Dr. Damian Evans.
- Angkor is located in the Lower Mekong Basin which experienced heavy rainfall during the summer monsoons and a strongly marked dry season during winters.
- West of Angkor Thom (inner royal city of Angkor) is the vast Western Baray - a reservoir built in the 11th century. The earthen walls constructed to hold water form a perfect rectangle, oriented exactly east-west. Possibly the Western Baray and later, the Eastern Baray, were built to provide water to the city, control water levels on the Siem Reap River, and provide irrigation water to the surrounding plain.

Photograph Source: https://www.britannica.com/



Step-wells and Tanks of Western India

- **'Tankas'** or **water collection tanks** were constructed to store and conserve rain water in forts and palaces.
- **Step-wells ('vav' or 'baori')** commonly seen in western India are wells, cisterns or ponds with a long corridor of steps that descend to the water level. Step-wells are irrigation tanks built mainly to cope with seasonal fluctuations in water availability. The step-wells make it easier for people to reach the groundwater and to maintain and manage the well compared to traditional tanks.

Tankas, Nahagarh Fort, Jaipur

Chand Baori, Rajasthan

Step-well inside Sun Temple complex of Modhera, Gujarat

Rani Ki Vav, Gujarat

Cauvery Delta Irrigation System by Cholla Kings

Built by Chola King Karikalan during the first century, **Grand Anicut ('Kallanai')**, is one of the oldest water-diversion or water regulating structures in the world. The dam plays an important role in the irrigation system in the Cauvery delta.

Assignment 1

Find out one example of ancient hydraulic structure and describe its significance in your own words. Supplement your writings with suitable pictures and videos from internet.