IQRA National University, Peshawar
Department of Electrical Engineering
Spring 2020
Power Generation

Name:________________

Terminal Examination *course Instructor: Engr.Sanaullah Ahmad*

Note: Attempt all Questions & Draw diagrams where necessary.

Question No 1 ***20***

A. With the help of a diagram show different Elements of a Hydropower Plant? CLO 1
B. Water for a small hydroelectric station is to be made available from a pondage with a volume of $5 \times 10^5 m^3$ located at a height uphill to provide water at a head of 100m at a hydraulic efficiency of 85% If the electrical efficiency is 94% and the water supply is available for 8 hours daily, determine the capacity of the generator to be installed at the power station. CLO 2

Question No 2 ***20***

A. Classify different hydropower turbines, what are the parameters required for the selection of hydropower turbines? CLO1
B. Select a suitable turbine for a hydropower scheme with available head height of 190m and rated discharge of 2.2 m^2/s with overall efficiency of 85%? Also determine turbine diameter and jet diameter? Specific speed $Ns = 85.49/(h)^{0.243}$. *Diameter* = $38.56 \sqrt{h}/n$. *Jet Diameter* $q = (\prod dj^2)Vj/4$ *where* $Vj = \sqrt{2gh}$ CLO 2

Question No 3 ***10***

Explain different stages of Nuclear Fuel Cycle? CLO 1

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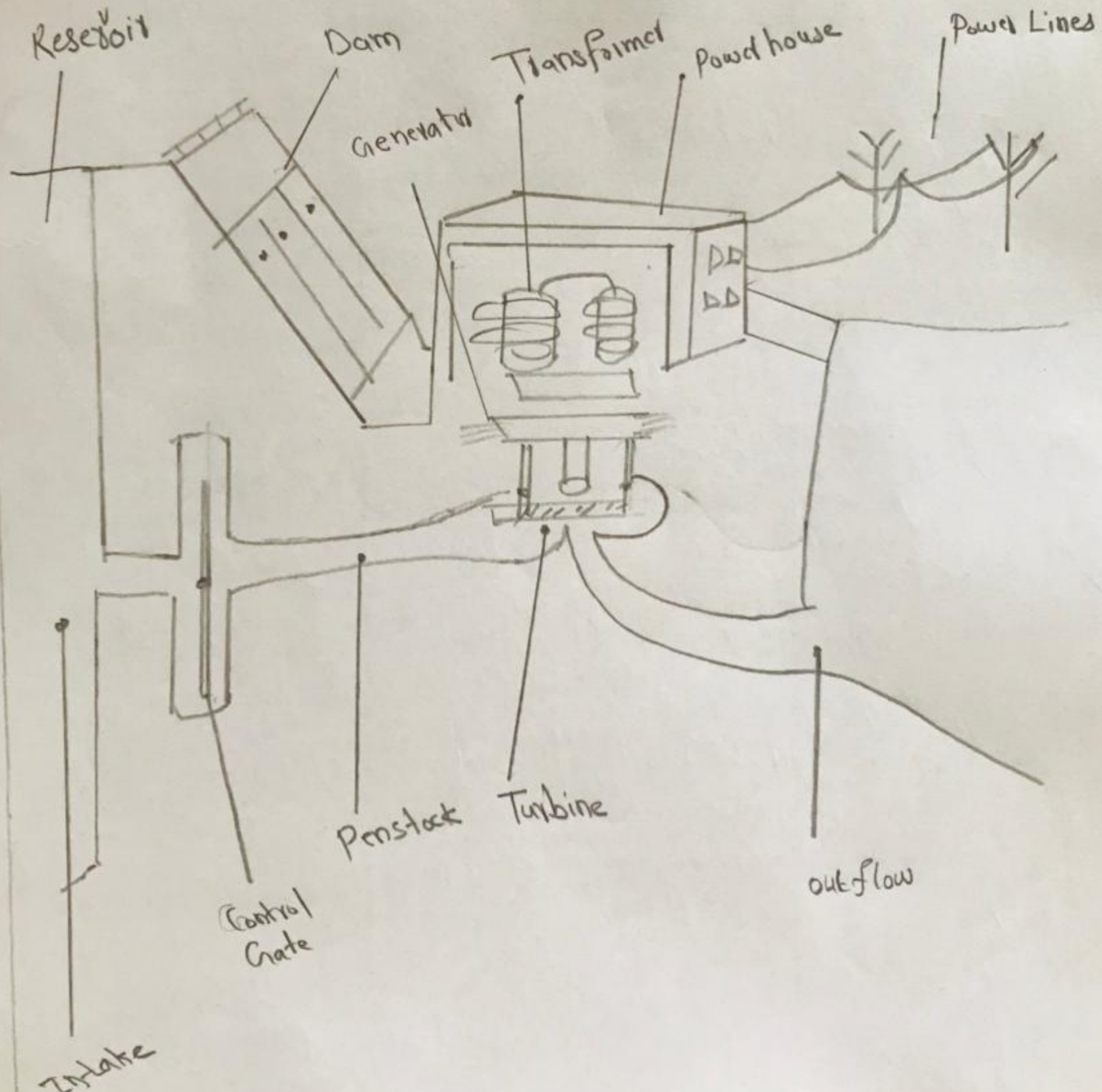
Q1 (A) With the help of a diagram Show efferent Elements of a hydropower plant?

Ans



Q(1) (B)

Solution:

Given Data:

available volume at pondage: $V = 5\times10^5 m^3$

Available head $h = 100m$

Hydraulic efficiency = 85% 0.85

Electrical efficiency = 0.94

Therefore:

overall efficiency = 0.85×0.94

= 0.80

using

$$E = \eta \rho g h V$$

$$= 0.8 \times 100 \times 9.81 \times 100 \times 5 \times 10^5$$

$$E = 3.92 \times 10^{11} W\text{-}s$$

Q(2) (A)

Ans Classify different hydropower turbines.

Reaction Turbines:

- Derive power from pressure drop across turbine
- Totally immersed water
- Angular and linear motion converted to shaft power
- propeller, francis and kaplan, turbines

Impulse Turbines:

- convert kinetic energy of water jet hitting buckets.
- No pressure drop across turbines
- pelton, Turgo and crossflow Turbines

High >50m

Medium (10-50m)

Low (<10)

Kaplan $2 < H < 40$

francis $10 < H < 350$

Pelton $50 < H\ 1300$

Turgo $50 < H\ 250$

	High	Medium	low
impulse	Pelton Turgo Multi-jet pelton	Cross flow Turgo Multi-jet pelton	Cross flow
Reaction		francis pump as Turbine	Propeller Kaplan

(2) (B)

(5)

Solution:

Given Data:

Head = $H = 190m$

$q = 2.2 m^3/s$

overall efficiency = $85\% = 0.85$

Solution

$Ns = 8.549(h)^{0.243}$

$Ns = ?$

~~Dea~~ Diameter = ?

Jet Diameter

As we know that:

$$Ns = \frac{85.49}{(h)^{0.243}}$$

$$Ns = \frac{85.49}{(190)^{0.243}}$$

$Ns = 23.88 rpm$

(8)

At 250rpm at 50Hz

$D = 38.56\sqrt{h}/n$

$D = 38.56 \times \frac{\sqrt{190}}{250}$

$= 12m$

$N_s = 23.88 rpm$

$D = 38.56 \frac{\sqrt{190}}{23.88}$

$D = 38.56 \times \frac{13.78}{23.88}$

$D = 38.56 \times 0.577$

$D = 22.25$

Jet diameter

$q = (\pi d_j^2) v_j / 4$

$d_j \sqrt{\frac{4q}{\pi v_j}}$

where

$v_j \sqrt{2gh} = \sqrt{2 \times 9.81 \times 190} = 61.05 m/s$

$d_j = \sqrt{\frac{4q}{\pi v_j}} = \sqrt{\frac{4 \times 2.2}{3.14 \times 61.05}}$

$= 0.214m$ or

21.4 cm

Q3 Explain different Stages of Nuclear fuel Cycle?

Ans:

The Nuclear fuel cycle represents The progression of Nuclear fuel from creation to disposal. In The united States, uranium is processed in different chemical and Physical from to create Nuclear fuel, Mixed oxide is another type of Nuclear fuel. As illustrated below, The nuclear fuel cycle typically Indears The following Stages:

① Uranium recovery: To extract (or mine) uranium ore, and concentrate (or mill) The to produce a uranium ore concentrate, Same culled U_3O_8 or yellowcake'

⑧

Conversion: of uranium or concentrate into uranium hexafluoride (UF_6)

Enrichment:- to increase the concentrate into uranium-235 (U^{235}) in UF_6

Deconversion:

To reduce the hazards associated with the depleted uranium hexafluoride (DUF_6) or Tailing - produced in earlier stages of the fuel cycle fuel fabrications

To convert natural and UF_6 into UO_2

use of fuel in reactors (nuclear, power search, or naval propulsion)

* Interim storage of spent nuclear fuel

Reprocessing: (or recycling) of high level waste (current not done commercially

final disposition (disposal) of used fuel or high level waste.