



SHOUBRA FACULTY OF ENGINEERING

**Benha University**  
**Mechanical Engineering Department**  
**Second term (2014-2015)**

**Sheet No (7)**

**Faculty of Engineering-Shoubra**  
**3<sup>rd</sup> year (Mechanical Power)**  
**Hydraulic Machines**

- 1- Find the operating speed and diameter of the runner of a Kaplan turbine having the following specification :  
Rated power = 15400 HP  
Average head = 4.3 m  
Overall efficiency = 90%, assuming:
  - Diameter of the boss = 0.3 of the outer diameter
  - Speed ratio = 2
  - Flow ratio = 0.65
- 2- A propeller turbine has an outer diameter of 4.5 m and an inner diameter of 2 m and develops 28000HP, when running at 140 rpm under a head of 22 m. the hydraulic efficiency of 94% and overall efficiency is 80%. Find the discharge through the turbine and the guide vane angle.
- 3- A Kaplan turbine develops 2000 HP under a head of 6 m. the turbine is 2.5 m above tailrace level. A vacuum gauge inserted at the turbine outlet records a suction head of 3.1 m, if the turbine efficiency is 85%, what will be the efficiency of the draft tube having losses of 0.5 times the exit velocity head and inlet diameter of 3m.
- 4- Calculate the diameter and the speed of a propeller turbine runner to develop 10 MW under a head of 5 m, the speed ratio based on outer diameter is 2.1, the flow ratio is 0.65, diameter of the boss is 0.35 of the external diameter of the runner. The overall efficiency is 88%. If the hydraulic efficiency is 94%, determine the inlet and outlet blade angles at the mean radius.
- 5- A Kaplan turbine has the following data :
  - Outer diameter = 4m
  - Inner diameter = 2m
  - Power = 20879 kW
  - Head = 20 m
  - Speed of the turbine = 136.4 rpmAssuming the hydraulic and overall efficiency and find the discharge and the runner vane angles at inlet and outlet, at the hub and at the edge of the blade.