

(OLD COURSE)

QP Code : 4239

(3 Hours)

[Total Marks : 100

- N.B:
- 1) Question No. 1 is compulsory.
 - 2) Attempt any four questions out of remaining six questions
 - 3) Assume suitable data wherever necessary.
 - 4) Figures to the right indicate Marks

Page 1/3

1. Answer any four of the following questions 20
 - i) Explain the difference between Impulse and Reaction turbine
 - ii) Explain the function of draft tube
 - iii) What is the function of air vessel in reciprocating pump?
 - iv) Why a Pelton turbine has notch like edge? How does it affect efficiency of turbine
 - v) What is axial thrust in centrifugal pump?

2. (A) A single jet Pelton turbine drives generator which has an output power of 15 MW. The efficiency of the generator is 97 % and overall efficiency of the turbine is 85 %. The turbine works under a net head of 800 m. The nozzle coefficient is 0.97 and speed ratio is 0.46. The bucket deflects the jet through an angle of 165° and the relative velocity reduces by 15 % while passing over the buckets. Determine 12
 - i) Discharge through turbine
 - ii) Diameter of the jet
 - iii) Force exerted by jet on an individual bucket

- (B) Define all the efficiencies considered in the analysis of hydroelectric power plant from the head race to tail race. 08

3. (A) A Francis turbine works under a head of 60 m and develops 300 kW at 700 rpm. The flow ratio is 0.2. The width to diameter ratio at inlet is 0.1. The ratio of outlet diameter to inlet diameter is 0.5. The vane thickness reduces the flow area by 5 %. The overall efficiency is 84 % and the hydraulic efficiency is 92 %. The velocity of flow remains constant from inlet to outlet. The discharge is radial 12

Determine :-

- i) Guide blade angle
 - ii) Diameter at inlet and outlet
 - iii) Vane angles at inlet and outlet
 - iv) Width of the runner at inlet
- (B) Explain the function of guide vanes in reaction turbine 08
4. (A) A 1/5 scale turbine model is tested under a head of 15 m. The actual turbine will work under head of 30 m at a speed of 450 rpm. If model develops 100 kW of power using 1.1 m³/s of water, then calculate 12
- i) RPM of the model
 - ii) Power developed by prototype
- If actual turbine efficiency is 3 % better than the model; then account the scale effect.
- (B) What is mean by cavitation? What is Thoma's cavitation factor, what is its significance for water turbines? 08
5. (A) A constant speed test of a centrifugal pump gives the head discharge relationship as 12
- $$H = 45 + 250 Q - 4000 Q^2$$
- Where H is the head on the pump in metres and Q is the discharge in m³/s. The pump is used to lift water against a head of 30 m through a 400 mm diameter pipe 500 m long having a coefficient of friction $f = 0.025$. If the efficiency of the pump as 75%, determine the operating head and the corresponding discharge and power required to drive the pump
- (B) What are the different types of casings used in centrifugal pump? 08
6. (A) A double acting reciprocating pump has a piston of diameter 220 mm and a stroke length 600 mm. It sucks water from a sump in which the level of water is 4 m below the centre line of the pump. The length of the suction pipe is 6.5 m with diameter 150 mm. The friction factor $4f$ is 0.024 and separation occurs at 2.4 m of water absolute. Determine the maximum speed of the pump when there is 12
- i) No air vessel on the suction side
 - ii) A large air vessel on the suction side close to the cylinder
- (B) Write short note on performance characteristics of Reciprocating pump 08

3

QP Code : 4239

7. (A) A centrifugal pump lifts water under a static head of 36 m of water of 12 which 4 m is suction lift. Suction and delivery pipes are both 150 mm in diameter. The head loss in suction pipe is 1.8 m and in delivery pipe 7 m. The impeller is 380 mm in diameter and 25 mm wide at mouth and revolves at 1200 rpm. Its exit blade angle is 35° . If the manometric efficiency of the pump is 82 %, determine
- The discharge through the pump
 - The pressure at the suction and delivery branches of the pump
- (B) What is NPSH? What is the difference between NPSH available and NPSH required. 08