

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-V • EXAMINATION – SUMMER 2013****Subject Code: 151903****Date: 21-05-2013****Subject Name: Fluid Power Engineering****Time: 10.30 am - 01.00 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) With usual notations derive an expression for head loss due to sudden enlargement in pipe. **07**

- (b)** A 2500 m long pipeline is used for transmission of power 120 KW. The power is to be transmitted through the pipe in which water having pressure of 4000 K N/m^2 at inlet is flowing. If the pressure drop over the length of pipe is 800 K N/m^2 and $f=0.006$ calculate **07**
- i. Diameter of pipe and
 - ii. Efficiency of transmission.

Q.2 (a) Sketch and describe a modern method of regulation to maintain constant speed for Pelton turbine. Explain performance characteristic curves of pelton turbine. **07**

- (b)** A conical draft turbine tube having inlet and outlet diameter 1.2m and 1.8m discharges water at outlet with a velocity of 3m/s. The total length of draft tube is 7.2 m and 1.44 m of the length of draft tube immersed in water. If the atmospheric pressure head is 10.3 m of water and loss of head due to friction in draft tube is equal to $0.2 \times \text{velocity head}$ at outlet of tube determine **07**
- i. Pressure head at inlet and
 - ii. Efficiency of draft tube.

OR

- (b)** A Kaplan Turbine produces 25MW operating under a head of 40 m. The blade tip diameter is 2.5 times the hub diameter and the overall efficiency is 0.9. If the speed and flow ratio are 2.0 and 0.6 respaly, calculate the diameter and speed of the turbine. **07**

Q.3 (a) A jet of water moving with velocity 22m/s impinges on a curved vane at the one end tangentially. The jet leaves the vane at an angle of 120° to the direction of motion of the vane. The velocity of vane is 10m/s and angle of nozzle is 20° . Determine **07**

- i. Vane angle at inlet and outlet,
 - ii. Work done per second per unit mass of water.
- (b)** With neat sketch explain construction and working of hydraulic torque converter. **07**

OR

Q.3 (a) Show that the efficiency of propulsion when the inlet orifice face the direction of motion of ship is given by $\eta = \frac{2u}{V+2u}$, where V is the absolute velocity of issuing jet and u is velocity of ship. **07**

- (b)** Write short notes on: Hydraulic intensifier and Air lift pump **07**

- Q.4 (a)** Explain the following **07**
- i. Influence of inlet and outlet blade angles on performance of centrifugal compressor
 - ii. Testing of pump as per B.I.S.
- (b)** A double acting reciprocating pump is fitted with an air vessel on suction side close to pump. The suction lift of pump is 4.5m. The length and diameter of suction pipe are 7.5m and 80mm resp. The stroke of piston and its diameter both are 200 mm each. Coefficient of friction is 0.01. The atmospheric pressure head is 10.3m and separation pressure head 2.5m of water absolute. Determine **07**
- i. The speed at which separation commences
 - ii. Maximum permissible speed without air vessel.

OR

- Q.4 (a)** With neat sketch explain construction and working of Mud pump and deep well pump **07**
- (b)** The impeller of centrifugal pump is 1m in diameter and rotates at 1500 rpm. The blades are curved backward and make an angle of 30° to the tangent at the periphery. Calculate the power required if the velocity of flow at outlet is 20m/s. Determine the head to which water can be lifted when a diffuser casing reduces the outlet velocity to 60%. **07**
- Q.5 (a)** With usual notations derive an expression for indicated work of reciprocating air compressor by considering clearance. **07**
- (b)** In an axial flow compressor, overall stagnation pressure achieved is 4 and overall stagnation isentropic efficiency 85%. The inlet stagnation pressure and temperature are 1 bar and 300 K resp. The mean blade velocity is 180m/s. degree of reaction 50% at mean radius with relative air angles of 12° and 32° at rotor inlet and outlet resp. The work done factor is 0.9 calculate **07**
- i. Stagnation polytropic efficiency
 - ii. Inlet temperature and pressure
 - iii. Number of stages
 - iv. Blade height in first stage, if ratio of hub to tip diameter is 0.42, mass flow rate is 19.5 Kg/s.

OR

- Q.5 (a)** With neat sketch explain construction and working of Scroll compressor. **07**
- (b)** Calculate the power required to run the vane compressor and its efficiency, when it handles 6m^3 of air per minute from 1 bar to 2.2 bar. The pressure rise due to compression in compressor is limited to 1.6 bar. Assume mechanical efficiency of compressor 80%. **07**
