

# C.U.SHAH UNIVERSITY

## Winter Examination-2015

Subject Name : Fluid Power Engineering

Subject Code : 4TE05FPE1

Branch :B.Tech (Mech)

Semester : 5    Date :02/12/2015    Time :2:30 To 5:30    Marks :70

Instructions:

- (1) Use of Programmable calculator & any other electronic instrument is prohibited.
  - (2) Instructions written on main answer book are strictly to be obeyed.
  - (3) Draw neat diagrams and figures (if necessary) at right places.
  - (4) Assume suitable data if needed.
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Q-1

**Attempt the following questions:**

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- a) When a jet of water impinges on a fixed inclined plate
  - (a) No force is exerted by a jet
  - (b) The work done is maximum
  - (c) Momentum remain unaffected
  - (d) Flow is divided into branches according to inclination angle.
- b) The maximum efficiency of jet propulsion of a ship with inlet orifices at right angles to the direction of motion of ship is
  - (a) 40% (b) 50% (c) 80% (d) 60%
- c) Braking jet in an impulse turbine is used
  - (a) to break the jet of water
  - (b) to change the direction of runner
  - (c) to bring the runner to rest in a short time
  - (d) none of these
- d) Which of the following turbine is preferred for 0 to 25 m head of water?
  - (a) Francis turbine (b) Kaplan turbine (c) Pelton wheel (d) none of these
- e) The speed of an imaginary turbine, identical with the given turbine, which will develop a unit power under a unit head is known as
  - (a) none of these (b) normal speed (c) unit speed (d) specific speed
- f) The overall efficiency of a reaction turbine is the ratio of
  - (a) work done on the wheel to the energy actually supplied to the turbine
  - (b) actual work available at the turbine to the energy imparted to the wheel
  - (c) power produced by the turbine to the energy actually supplied by the turbine
  - (d) none of the above
- g) Power required to drive a centrifugal pump is directly proportional to \_\_\_\_\_ of its impeller.
  - (a) fourth power of diameter (b) diameter
  - (c) cube of diameter (d) square of diameter
- h) Multi-stage centrifugal pumps are used to
  - (a) Give high discharge (b) Produce high head
  - (c) pump viscous fluid (d) all of these



- i) A centrifugal pump will start delivering liquid only when the pressure rise in the impeller is equal to the
  - (a) kinetic head (b) manometric head (c) velocity head (d) static head
- j) Inter cooling in compressors
  - (a) results in saving of power in compressing a given volume to given pressure
  - (b) cools the delivered air
  - (c) is the standard practice for big compressors
  - (d) enables compression in two stages
- k) Ratio of indicated H.P. and brake H.P. of compressor is known as
  - (a) mechanical efficiency (b) volumetric efficiency
  - (c) isothermal efficiency (d) adiabatic efficiency
- l) In multistage compressor the isothermal compression is achieved by
  - (a) employing intercooler (b) by constantly cooling the cylinder
  - (c) by insulating the cylinder (d) by running compressor at very slow speed
- m) The working of which of the following hydraulic units is based on Pascal's law?
  - (a) Air lift pump (b) Jet pump (c) Hydraulic coupling (d) Hydraulic press
- n) A hydraulic coupling belongs to the category of
  - (a) power developing machines (b) power absorbing machines
  - (c) energy transfer machines (d) energy generating machines

**Attempt any four questions from Q-2 to Q-8**

**Q-2**

**Attempt all questions**

- a) Explain Jet Propulsion of ship. **07**
- b) A jet of water having velocity of 35 m/s impinges on a series of curved vane moving with a velocity of 20 m/s. The jet makes an angle of  $30^\circ$  to the direction of motion of vane when entering and leaves at an angle of  $120^\circ$ . **07**  
 Draw the velocity diagram at inlet and outlet of vane and find:
  - (i) Vane angle at inlet and outlet
  - (ii) Work done/kg of water entering the system
  - (iii) Efficiency of the system.

**Q-3**

**Attempt all questions**

- a) What is a draft tube? Why is it used in a reaction turbine? What are the various types of it? **07**
- b) Define the term "Governing of a turbine". Explain with neat sketch governing mechanism of Pelton Turbine. **07**

**Q-4**

**Attempt all questions**

- a) Enlist the various types of impeller used in centrifugal pump and explain any one from it with a neat sketch. **07**
- b) A Pelton wheel is supplied with water under a head of 100 m at the rate  $1 \text{ m}^3/\text{s}$ . The bucket deflects the jet through an angle of  $160^\circ$ . The mean speed of bucket is 20 m/s. Find: (i) Mass flow rate of water (ii) Velocity of jet (iii) Power output (iv) Hydraulic efficiency of turbine **07**



- Q-5**      **Attempt all questions**
- a) Discuss Characteristic curves of Hydraulic turbines. **07**
- b) The internal and external diameters of the impeller of a centrifugal pump are 20 cm and 40 cm respectively. The speed of the pump is 1400 rpm. Assuming a constant velocity of flow of 5 m/s throughout, radial entry to impeller vanes and the exit vane angle of  $30^\circ$ . Find:  
(i) Inlet vane angle, (ii) Work done by impeller per N weight of water. **07**
- Q-6**      **Attempt all questions**
- a) Define Slip factor, Work factor, Pressure coefficient, Prewhirl for a centrifugal compressor. **07**
- b) A single acting two stage compressor with complete intercooling delivers 10 kg/min of air at 16 bar. The suction occurs at 1 bar and  $15^\circ\text{C}$ . The compression and expansion processes are reversible polytropic with polytropic index  $n = 1.25$ . Calculate: (i) The power required (ii) The isothermal Efficiency (iii) The free air delivery (iv) Heat transferred in intercooler. **07**
- Q-7**      **Attempt all questions**
- a) Explain the phenomenon of surging and stalling in an axial flow air compressor. **07**
- b) Briefly differentiate Reciprocating and rotary compressor. **07**
- Q-8**      **Attempt all questions**
- a) Explain working of Differential hydraulic accumulator with neat sketch. **04**
- b) Write a short note on hydraulic ram. **05**
- c) Write a short note on Fluid torque converter **05**

