Enrollment No: _____ Exam Seat No:_____

C.U.SHAH UNIVERSITY
Summer Examination-2020

Subject Name: Fluid Power Engineering

Subject Code: 4TE05FPE1 Branch: B.Tech (Mechanical)

Semester: 5 Date: 26/02/2020 Time: 10:30 To 01:30 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.

Q-1 Attempt the following questions: (14)

a) Discharge of a centrifugal pump is (where N = Speed of the pump impeller)
(a) directly proportional to N (b) inversely proportional to N
(c) directly proportional to N^2 (d) inversely proportional to N^2

b) The force exerted by a jet of water in the direction of jet on a stationary curved plate is (a) ρav2 (b) ρav2 sin2θ (c) ρav2 (1+cos2θ) (d) ρav2 (1+sinθ)

c) In a centrifugal compressor, an increase in speed at a given pressure ratio causes
(a) increase in flow (b) decrease in flow (c) increase in efficiency (d) increase in flow and decrease in efficiency

d) The ratio of the work done on the blades to the energy supplied to the blades, is called
(a) blading efficiency (b) nozzle efficiency (c) gross or stage efficiency (d) mechanical efficiency

e) De-Laval turbine is a
(a) single rotor impulse turbine (b) multi-rotor impulse turbine (c) impulse reaction turbine (d) None of these

f) Which of the following turbine is preferred for 0 to 25 m head of water
(a) Pelton wheel (b) Kaplan turbine (c) Francis turbine (d) none of these

g) A hydraulic coupling belongs to the category of
(a) power absorbing machines (b) power developing machines (c) energy transfer machines (d) energy generating machines

h) The principle of jet propulsion is used in driving the ships and aero planes
(a) Correct (b) Incorrect

i) The maximum delivery pressure in a rotary air compressor is
(a) 10 bar (b) 20 bar (c) 30 bar (d) 50 bar

j) The discharge is _____ at critical pressure.
(a) Zero (b) Minimum (c) Maximum

k) _____ pump is also called as velocity pump.
(a) Reciprocating (b) Rotary (c) Screw (d) Centrifugal

l) Which of the following pump is successfully used for lifting water to the turbines
(a) Centrifugal pump (b) Reciprocating pump (c) Jet pump (d) Air lift pump

m) In a Kaplan turbine runner, the number of blades are generally between (a) 2 to 4 (b) 4 to 8 (c) 8 to 16 (d) 16 to 24

n) The water jet after striking the flat plate will be deflected at an angle of (a) 1100 (b) 600 (c) 900 (d) None of these

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

Q-2 **Attempt all questions**

a) Derive the expression for the efficiency of system while impact of jet on a series of flat moving plate and also write the condition of maximum efficiency **(07)**

b) Derive the equation for efficiency of propulsion for ship when orifices face the direction of motion of ship. **(07)**

Q-3 **Attempt all questions**

a) Define specific speed for turbine. Derive its equation for hydraulic turbine. Give classification of hydraulic turbines based on value of specific speed **(07)**

b) A Kaplan turbine develops 15000 kW power with a head of 30 m. Hub diameter of runner is 0.35 times the outer diameter of the runner. Assuming a speed ration of 2 and flow ratio of 0.65 and overall efficiency of 90 %. Calculate: (i) diameter of runner (ii) rotational speed of turbine (iii) specific speed **(07)**

Q-4 **Attempt all questions**

a) Explain the following terms: Cavitation, Multistage pumps, Air vessels, Priming. **(07)**

b) Draw the inlet and outlet velocity diagram for a Pelton wheel. Obtain an expression for work done and hydraulic efficiency **(07)**

Q-5 **Attempt all questions**

a) Define and derive equation of NPSH in centrifugal pump? How its value significantly affects efficiency of centrifugal pump. **(07)**

b) A three stage centrifugal pump has impeller 40 cm diameter and 2 cm wide at outlet. The vanes are curved back at the outlet at 450 and reduce the circumferential area by 10 %. Its manometric efficiency is 90% and overall efficiency is 80 %.Determine the heat generated by pump when running at 1000 rpm delivering 50 liters per second. What should be the shaft power in kW **(07)**

Q-6 **Attempt all questions**

a) Compare the following: (i) Centrifugal compressor and Axial Flow compressor (ii) Rotary compressor and Reciprocating compressor **(07)**

b) Explain the term surging and choking and also discuss the performance characteristics curves of reciprocating compressor. **(07)**

Q-7 **Attempt all questions**

a) With neat sketch explain construction and working of Hydraulic lift. **(07)**

b) A hydraulic lift of direct type is required to lift the load of 100 kN at a velocity of 0.75 m/sec having a ram diameter of 16 cm. Water from mains is supplied at a pressure of $16.7*10^6$ N/m^2 through a pipe 320 m long and having a friction factor of 0.01. Assuming that 6 % of cylinder pressure is lost in gland friction determine (i) Rate of discharge water (ii) Friction losses in pipe (iii) Diameter of pipe **(07)**

Q-8 **Attempt all questions**

a) Explain with neat sketch, construction and working of Hydraulic ram. **(07)**

b) Explain the working of a single stage reciprocating compressor with the help of schematic and P-V diagrams. **(07)**