Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FOURTH SEMESTER B.TECH DEGREE EXAMINATION(R&S), MAY 2019

Course Code: ME206
Course Name: FLUID MACHINERY (ME)

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any three questions, each carries 10 marks Marks

1 a) Find an expression for the efficiency of a series of moving curved vanes when a jet of water strikes the vanes at one of its tips and show that the maximum efficiency is 50%. (4)

   b) (i) Find the force exerted by the jet on a stationary vertical plate. (3)

       (ii) find the force exerted by a jet of water of diameter 75mm on a stationary flat plat, when the jet strikes the plate normally with velocity of 20m/s. (3)

2 a) A Pelton wheel is to be designed for a head of 60m when running at 200r.p.m. The Pelton wheel develops 95.6475kw shaft power. The velocity of the buckets is 0.45 times the velocity of the jet, overall efficiency is 0.85 and co-efficient of the velocity is equal to 0.98 (6)

   b) Define the following terms of Turbine:

       (i) Gross head (4)

       (ii) Net head

       (iii)Hydraulic efficiency

       (iv)Mechanical efficiency

3 a) i) What is governing of turbines? (1)

       ii) With neat sketch explain the governing of impulse turbine. (4)

   b) What is the function of draft tube? With neat sketch explain draft tube theory (5)

4 a) A turbine is operating under a head of 25m at 200r.p.m. The discharge is 9m³/s. If the efficiency is 90%, determine: (6)

       (i)   Power generated

       (ii)   Specific speed of the turbine, and

       (iii)   Type of turbine.

   b) (i) what is the significance of Type number in Turbines (4)

       (ii) Define specific speed of a turbine. Derive an expression for the same.

PART B
Answer any three questions, each carries 10 marks

5   a)   The diameter of an impeller of a centrifugal pump at inlet and outlet are 30cm   (4)
and 60cm respectively. Determine the minimum starting speed of the pump if it
works against a head of 30cm.

     b)   With neat sketch explain the performance characteristic curves of a centrifugal   (6)
pump.

6   a)   Define the following terms of centrifugal pump   (4)

           (i)   Suction head

           (ii) Delivery head

           (iii)Static head

           (iv)Manometric head.

     b)   (i) With neat sketch explain various losses in pumps.   (3)

         (ii) What is priming and explain the necessity of priming   (3)

7   a)   i) Define ideal indicator diagram.   (2)

         ii) Show that area of indicator diagram is proportional to the work done by the   (4)
reciprocating pump

     b)   A single acting reciprocating pump, running at 50 r.p.m delivers 0.01m³/s of   (4)
water. The diameter of the piston is 200mm and stroke length 400mm.
  determine:

           i)   The theoretical discharge of the pump.

           ii)   Co-efficient of discharge

           iii) Slip and percentage slip of the pump.

8   a)   Show from first principle that work saved against friction in the delivery pipe of
a double – acting reciprocating pump, by fitting air vessel is 39.2%.   (4)

     b)   With neat sketch explain the following

           (i)   Hydraulic Ram   (3)

           (ii) Lobe pump   (3)

PART C
Answer any four questions, each carries 10 marks

9   a)   A single acting, single cylinder reciprocating air compressor has a cylinder   (5)
diameter of 200mm and a stroke of 300mm. Air enters the cylinder at 1bar,
27ºC. It is then compressed polytropically to 8 bar according to the law $PV^{1.3} = $
Constant. If the speed of the compressor is 250rpm, calculate (i) the mass of air
compressed per minute and (ii) the power required in KW for driving the
compressor, if mechanical efficiency is 80%. Neglect clearance.

b) Prove that the work done per Kg of air in a compressor is given by   (5)

$$W = RT_1 \frac{n}{n-1} [(r_p)^{\frac{n}{n-1}} - 1] \text{ where } (r_p) = \text{pressure ratio.}$$

10   a)   A single stage reciprocating air compressor is compressing 2kg of air per minute   (5) at 1 bar 20°C and it delivers it at 7 bar. Assuming compression process follows the law $PV^{1.3}$ = Constant. Calculate indicated power input to compressor, neglect clearance.

     b)   Prove that for complete inter - cooling between two stages, the compression work   (5) would be minimum when intermediate pressure $p_2 = \sqrt{p_1 \times p_3}$ where p_1 and p_3 are suction and delivery pressure respectively.

11   a)   State how are the air compressors classified?   (4)

     b)   Describe with a neat sketch the construction and working of a single-stage,   (6) single-acting reciprocating air compressor?

12   a)   With neat sketch explain surging and chocking   (5)

     b)   Explain the methods to improve the isothermal efficiency of an air compressor   (5)

13   a)   `Air at a temperature of 305^0K flows in a centrifugal compressor running at   (6) 16000 rpm. Isentropic efficiency of the compressor is 80%. Outer diameter of the blade tip is 600mm. Take slip factor as 0.85. Calculate

         (i)   The temperature rise of air passing through the compressor

         (ii)   The static pressure ratio.

     b)   Derive the expression for width of impeller blade for centrifugal compressor   (4)

14   a)   With neat sketch explain the construction and working of a vane compressor   (4)

     b)   Discuss the merits and demerits of a centrifugal compressor over axial flow   (6) compressor.

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