B.E. Sixth Semester (Mechanical Engineering) (CGS)

10861 : Fluid Power - II : 6 ME 01

P. Pages : 3 | AU - 2740

Time : Three Hours | Max. Marks : 80

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Notes : 1. Answer **three** question from Section A and **three** question from Section B.
2. Due credit will be given to neatness and adequate dimensions.
3. Assume suitable data wherever necessary.
4. Illustrate your answer necessary with the help of neat sketches.
5. Use of pen Blue/Black ink/refill only for writing the answer book.

SECTION – A

1. a) Derive an expression for specific speed of a turbine. What are the ranges of the specific speeds for Pelton, Francis and Kaplan turbine? **6**

b) The following data pertains to an inward flow reaction turbine: **7**
Net head = 60 m, speed = 650 RPM, Brake power = 275 kW, Ratio of wheel width to wheel diameter at inlet = 0.1 Ratio of inner diameter to outer diameter = 0.5, flow ratio $K_f = 0.17$, hydraulic efficiency = 0.95, Overall efficiency = 0.85 The flow velocity remains constant and discharge is radial. Neglecting area blockages by blades, work out main dimensions and blade angles of the turbine.

OR

2. a) Why is the efficiency of Kaplan turbine nearly constant irrespective of speed variation under load? **6**

b) It is desired to generate 1000 kW of power and survey reveals that 450 m head and a minimum flow of 0.3 m^3/s is available. Comment whether the task can be accomplished by installing a Pelton wheel that turns 1000 RPM and has an overall efficiency of 80% Further design the Pelton wheel by assuming $C_v = 0.98$, and $K_u = 0.46$ **7**

3. a) Explain with neat sketches the following types of casings. **6**
i) Vortex casing. ii) Casing with guide blades.

b) During a test on a centrifugal pump the following readings were obtained **7**
Pressure gauge reading = 1.32 bar
Vacuum gauge reading = 300 mm of Hg
Effective height between gauges = 0.45 m
Power of electric motor = 22 kW
Discharge of pump = 85 LPS.
Diameter of delivery pipe = 150 mm
Diameter of suction pipe = 200 mm
Determine the overall efficiency of the pump.

OR

4. a) Define the following terms related to centrifugal pump. **6**
i) Manometric head ii) Manometric efficiency
iii) NPSH and iv) Priming

b) A three stage centrifugal pump has impellers 30 cm diameter and 1.5 cm width at outlet. The velocity of water at inlet is radial. The vanes are curved back at an angle of 30° to the tangent at outlet and occupy 8% of outlet area while running at 1000 RPM. The pump delivers 40 LPS with 85% manometric efficiency and 75% overall efficiency. Calculate the head generated by the pump and the input power. 7

5. a) Explain with a neat sketch the working of a hydraulic ram. What are its advantages compared to the pumps with a conventional prime mover? 7

b) Sketch and describe the construction and working of an air lift pump. 7

OR

6. a) Describe with a neat sketch, the construction and operation of an axial flow pump. What are its applications? 7

b) The Impeller of a propeller pump is 1m in diameter while the boss is 0.5m in diameter. Find the most suitable speed to provide a head of 6 m. the velocity of flow through the impeller is 2 m/s and specific speed of the pump is 38. Also determine vane angle at the entry of the pump at the exterior tip. 7

SECTION – B

7. a) What is an indicator diagram? Draw an ideal indicator diagram for a single acting reciprocating pump and prove that work done by the pump is proportional to the area of indicator diagram. 6

b) A double acting reciprocating pump running at 50 rpm, delivers 8.4 LPS of water. The diameter of piston is 15cm and stroke length is 30 cm. The static head of the pump is 25m. The suction pipe is 5m long and 100 mm in diameter. Find the percentage slip and power required to run the pump. Also calculate the acceleration head at the beginning of suction stroke. 7

OR

8. a) Give a comparison between reciprocating and centrifugal pump on the basis of the following. 6

1)	Discharge and head.	2)	Speed
3)	Operation and maintenance.	4)	Floor area and initial cost
5)	Efficiency.	6)	Nature of discharge.

b) Find the maximum safe speed of a single acting reciprocating pump which is installed at 5m above the sump water level. Diameter and length of suction pipe are 7 cm and 6.5m respectively. Piston has a diameter of 10 cm and stroke length is 25 cm. If the separation of water occurs when the absolute pressure head falls below 2.5 m of water. Assuming the atmospheric pressure to be 10.3m of water. 7

9. a) Explain the following terms in the context of compressible flow with the help of sketches. 6

i)	Mach number	ii)	Mach angle
iii)	Mach cone	iv)	Mach line

b) Find the Mach number when an Aeroplane is flying at 1100 km/hr. through still air having a pressure of 7 N/cm^2 and temperature –5°C. Wind velocity may be taken as zero. Take R = 287 J/kg K. Calculate the pressure, temperature and density of air at stagnation point on the nose of the plane. Take r = 1.4. 7

OR

10. a) Show that for steady one dimensional isentropic compressible flow through a duct. 6
$\frac{dA}{A} = \frac{dv}{v}\left(M^2 - 1\right)$.
and explain its implication in the design of nozzles and diffuser.

b) The static and stagnation temperatures of a stream of air are 15°C and 50°C respectively. 4
Estimate the Mach number and flow velocity.

c) Find the sonic velocity. 3
i) For water having a bulk modulus of 2.05×10^6 kN/m^2.
ii) For air at 280K. and
iii) For crude oil of sp.gr. 0.8 and bulk modulus 1.5×10^6 kN/m^2.

11. a) Describe with neat schematic diagrams the working of- 14
i) Hydraulic lift ii) Actual hydraulic press

OR

12. a) Describe with a neat schematic diagram the working of a hydraulic coupling. 7

b) Describe with a neat schematic diagram the working of a hydraulic intensifier. 7

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