

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FOURTH SEMESTER B.TECH DEGREE EXAMINATION, APRIL 2018

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) Prove that the maximum efficiency of a jet impinging on a series of moving flat plate is 50%. | (5) |
| | b) Explain the constructional features of Pelton turbine. | (5) |
| 2 | a) Define the following: | (4) |
| | i) Cross head ii) Net head iii) Hydraulic efficiency iv) Overall efficiency | |
| | b) Derive the expression for maximum hydraulic efficiency of a Pelton wheel. | (6) |
| 3 | a) Explain the types and functions of draft tube. | (4) |
| | b) Kaplan turbine works under a head of 26.5 m, the flow rate of water being 170m ³ /s. The overall efficiency is 90%. Determine the power and specific speed. The turbine speed is 150 rpm. | (6) |
| 4 | a) What are unit quantities as applied to hydraulic turbines? Why are they important? | (4) |
| | b) In a draft tube arrangement for a reaction turbine the flow rate is 150m ³ /s. Inlet area of the draft tube is 15 m ² while the outside area is 22.5 m ² . The turbine runner outlet or the draft tube inlet is 0.5 m below the tailrace level. If the kinetic head recovered by the draft tube is 80% determine the pressure head at turbine outlet. | (6) |

PART B

Answer any three questions, each carries 10 marks

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| 5 | Differentiate between forced and free vortex Give some examples of occurrence. Show how the velocity and pressure vary with radius in free and forced vortex flow. | (10) |
| 6 | a) What is Euler head of a centrifugal pump? | (4) |
| | b) The diameter and width of a centrifugal pump impeller are 50 cm and 2.5 cm. The pump runs at 1200 rpm. The suction head is 6 m and the delivery head is 40 m. The frictional drop in suction is 2 m and in the delivery 8 m. The blade angle at outlet is 30°. The manometric efficiency is 80% and the overall efficiency is 75%. Determine the power required to drive the pump. Also calculate the pressures at the suction and delivery side of the pump. | (6) |
| 7 | a) Explain in brief how and when separation take place in a reciprocating pump also discuss the preventive measures to avoid that. | (4) |
| | b) The bore and stroke of a single acting reciprocating water pump are 20 cm and 30 cm. The suction pipe is of 15 cm diameter and 10 m long. The delivery pipe is 12 cm diameter and 28 m long. The pump is driven at 32 rpm. Determine the | (6) |

acceleration heads and the friction head, $f = 0.02$. Sketch the indicator diagram. The suction and delivery heads from atmosphere are 4 m and 16 m respectively.

- 8 a) What is an air vessel? Describe its functions. (4)
b) Show that in a double acting pump the work saved by fitting air vessels is about 39.2%. (6)

PART C

Answer any three questions, each carries 10 marks

- 9 a) What is clearance ratio? Write the effect of clearance volume on the performance of an air compressor. (4)
b) Derive the volumetric efficiency of a reciprocating compressor considering clearance volume. (6)
- 10 A single acting reciprocating compressor has bore of 25cm and a stroke of 35cm. (10)
The compressor runs at 650rpm. The clearance volume is 4% of swept volume. The index of expansion and compression is 1.3. The suction conditions are 0.95 bar and 25°C. The delivery pressure is 6 bar. The atmospheric pressure and temperature are 1.013 bar and 20°C. Determine:
i) FAD ii) Volumetric efficiency iii) Indicated power input.
- 11 Derive the condition for minimum work required for a 2-stage reciprocating air compressor. (10)
- 12 Explain the principle of operation, construction and working of a centrifugal compressor with necessary sketches. (10)
- 13 A centrifugal compressor running at 1500rpm has internal and external diameters of the impellers are 250mm and 500mm respectively the air enters the impeller radially. Determine the work done by the compressor per kg of air and degrees of reaction. (10)
- 14 a) Explain the working of diffuser in a centrifugal compressor. (4)
b) Explain the working of roots blower. (6)
