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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S4 (S,FE) / S2 (PT) (S,FE) Examination May 2024 (2015 Scheme)



Course Code: ME206

Course Name: FLUID MACHINERY (ME)

Maximum marks : 100

Duration : 3 hours

PART A

Answer any three questions, each carries 10 marks

Marks

- | | | |
|---|---|----|
| 1 | a) Derive an expression for the force exerted by a jet of water on moving inclined plate in the direction of jet. | 5 |
| | b) Prove that the maximum efficiency of a jet impinging on a series of moving flat plate is 50%. | 5 |
| 2 | A jet of water having a velocity of 18 m/s strikes a curved vane which is moving with a velocity of 6 m/s. The vane is symmetrical and so shaped that the jet is deflected through 120°. Determine (i) The angle of the jet at inlet of the vane so that there is no shock (ii) The absolute velocity of the jet at outlet in magnitude and direction and (iii) Work done per N of water. | 10 |
| 3 | a) Explain the constructional features of Francis turbine. | 4 |
| | b) Define the following i) Gross head ii) Net head iii) Hydraulic efficiency | 6 |
| 4 | a) Define unit speed of a turbine. Derive an expression for the same. | 4 |
| | b) A turbine is to operate under a head of 25 m at 200 rpm. The discharge is 9 m ³ /s. If the overall efficiency is 90%, determine (i) Power generated (ii) Specific speed of the turbine (iii) Type of turbine. | 6 |

PART B

Answer any three questions, each carries 10 marks

- | | | |
|---|--|---|
| 5 | a) What is meant by cavitation in centrifugal pump? List out its effects and remedies. | 6 |
| | b) Define NPSH. Explain its significance. | 4 |
| 6 | a) What is priming? Why is it necessary? | 4 |
| | b) Explain centrifugal pumps in series and parallel. | 6 |
| 7 | a) Show that the saving in work done against friction in a double acting reciprocating pump fitted with air vessel is 39.2%. | 6 |

- b) The bore and stroke of a double acting reciprocating pump are 15 cm and 30 cm respectively. The suction and delivery heads are 3 m and 30 m and the pump delivers $0.62 \text{ m}^3/\text{min}$ when running at 60 rpm. Find the percentage slip and power required to run the pump if mechanical efficiency is 80%. 4
- 8 A single acting reciprocating pump has a stroke length of 150 mm, suction pipe is 7 m long and the ratio of suction pipe diameter to the piston diameter being $3/4$. The water level in the sump is 2.5 m below the axis of the pump cylinder and the pipe connecting the sump and pump cylinder is 75 mm in diameter. If the crank is running at 75 rpm, determine the pressure head on the piston at the beginning, middle and end of the suction stroke. Take friction co-efficient, $f = 0.01$. 10

PART C

Answer any four questions, each carries 10 marks

- 9 a) Explain nomenclature of a reciprocating compressor. 4
- b) Derive the condition for minimum work required for a 2 stage reciprocating air compressor. 6
- 10 a) Explain the working of roots blower with a neat sketch. 4
- b) Obtain the expressions for volumetric efficiency of an air compressor in terms of clearance ratio, index of compression and pressure ratio. 6
- 11 a) Mention the advantages and disadvantages of multistage compression. 4
- b) A single stage single acting reciprocating air compressor is used to compress $7 \times 10^{-3} \text{ m}^3/\text{min}$ of air from a pressure of 1.013 bar to 14 bar. The index of polytropic compression is 1.3 and mechanical efficiency is 82%. Determine volumetric efficiency and power required to drive the compressor if the clearance volume is 3% the swept volume. 6
- 12 a) Define slip factor and pressure coefficient. 4
- b) Explain the construction and working of centrifugal compressor. 6
- 13 a) Draw velocity diagram to represent axial flow compressor. Obtain work done. 5
- b) Illustrate and explain the performance characteristics of air compressor. 5
- 14 a) Explain surging and choking in centrifugal compressors. 6
- b) With a neat sketch, explain the construction and working of a vane compressor. 4
