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**PRESIDENCY UNIVERSITY
BENGALURU**

SCHOOL OF ENGINEERING

TEST 1

Winter Semester: 2021 - 22

Course Code: MEC 303

Course Name: Turbomachinery

Program & Sem: B.Tech. (Mech) & 6th Sem

Date: 26th April 2022

Time: 01:30 PM to 2:30 PM

Max Marks: 30

Weightage: 15%

Instructions:

- (i) Read the all questions carefully and answer accordingly.
- (ii) Scientific and Non-programmable calculators are permitted.
- (iii) Question paper consists of 3 parts.

Part A [Memory Recall Questions]

Answer both the Questions. Each question carries 5 marks.

(3Qx 4M= 12M)

Q.NO.1. Define turbomachines and explain the different types of turbomachines.

[4] (C.O.No.1) [Knowledge]

Q.NO.2. Compare turbomachines and positive displacement machines.

[4] (C.O.No.1) [Knowledge]

Q.NO.3. Briefly explain the major parts of turbomachines.

[4] (C.O.No.1) [Knowledge]

Part B [Thought Provoking Questions]

Answer the Question.

(1Qx6M=6M)

Q.NO. 4. Explain the applications of first and second laws of thermodynamics to turbomachines.

[6] (C.O.No.1) [Comprehensive]

Part C [Problem Solving Questions]

Answer the Question.

(1Qx12M=12M)

Q.NO. 5. The resisting force F of a supersonic plane during flight can be considered as dependent upon the length of the aircraft L , velocity V , air viscosity μ , air density ρ and bulk modulus of air K . Express the functional relationship between these variables and the resisting force.

[12] (C.O.No. 1) [Application]



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**PRESIDENCY UNIVERSITY
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SCHOOL OF ENGINEERING

END TERM EXAMINATION

Winter Semester: 2021 - 22

Course Code: MEC 303

Course Name: Turbomachinery

Program & Sem: B.Tech. (Mech) & VI Sem

Date: 30th June 2022

Time: 09:30 AM to 12:30 PM

Max Marks: 100

Weightage: 50%

Instructions:

(i) *Read the all questions carefully and answer accordingly.*

(ii) *Scientific and Non-programmable calculators are permitted.*

Part A [Memory Recall Questions]

Answer all the Questions. Each question carries FIVE marks.

(7Qx 5M= 35M)

Q.NO.1. Define turbomachines and explain the different types of turbomachines.

[5] (C.O.No.1) [Knowledge]

Q.NO.2. What is the purpose of draft tube? Sketch any two types of draft tubes.

[5] (C.O.No.4) [Knowledge]

Q.NO.3. Briefly explain the major parts of turbomachines.

[5] (C.O.No.1) [Knowledge]

Q.NO.4. Briefly explain the working of Pelton wheel.

[5] (C.O.No.3) [Knowledge]

Q.NO. 5. Discuss the selection of hydraulic turbines for a project site

[5] (C.O.No.3) [Knowledge]

Q.NO. 6. Define (a) slip factor, (b) power input factor, and (c) pressure coefficient in the centrifugal compressor.

[5] (C.O.No.4) [Knowledge]

Q.NO. 7. How are centrifugal pumps classified? What are the basic criteria for the classification?

[5] (C.O.No.4) [Knowledge]

Part B [Thought Provoking Questions]

Answer all the Questions. Each question carries SEVEN marks.

(5Qx7M=35M)

Q.NO. 8. Explain the applications of first and second laws of thermodynamics to turbomachines.

[7] (C.O.No.1) [Comprehensive]

Q.NO. 9. An axial flow rotor is shown in Fig.1. State the direction of the flow, whether this is turbine or compressor and the direction of rotation. Sketch the representative velocity triangles.

[7] (C.O.No.2) [Comprehensive]

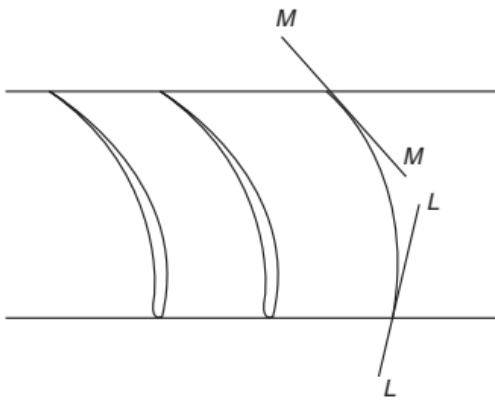


Fig.1. (Q. No. 9)

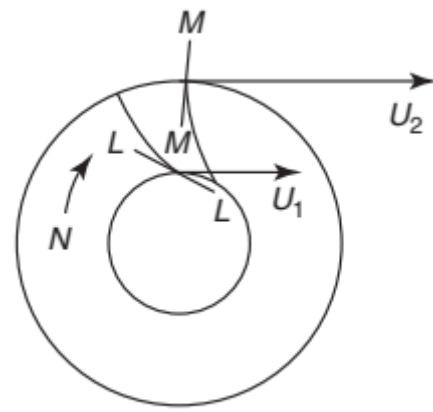


Fig.2. (Q. No. 10)

Q.NO. 10. A rotor is shown in Fig.2. The entry of fluid is radial and the flow is outward. The blades are radial at the outlet. Draw representative velocity triangles. [7] (C.O.No.2) [Comprehensive]

Q.NO. 11. What are the factors that affect the performance of an axial flow compressor? [7] (C.O.No.2) [Comprehensive]

Q.NO. 12. Draw a neat sketch of a Francis Turbine and indicate on it the following parts: Scroll casing, Guide vanes, Runner, Draft-Tube, Output shaft. [7] (C.O.No.3) [Comprehensive]

Part C [Problem Solving Questions]

Answer both the Questions. Each question carries FIFTEEN marks. (2Qx15M=30M)

Q.NO. 13. A Kaplan turbine produces 30,000 kW under a head of 9.6 m, while running at 65.2 rpm. The discharge through the turbine is 350 m³/s. The tip diameter of the runner is 7.4 m. The hub diameter is 0.432 times the tip diameter. Calculate (a) the turbine efficiency, (b) the specific speed of turbine, (c) the speed ratio (base on tip diameter), and (d) the flow ratio.

[15] (C.O.No. 4) [Application]

Q.NO. 14. The external and internal diameters of an inward flow reaction turbine are 2.0 m and 1.0 m respectively. The head on the turbine is 60 m. The width of the vane at inlet and outlet are same and equal to 0.25 m. The runner vanes are radial at inlet and the discharge is radial at outlet. The speed is 200 rpm and the discharge is 6 m³/s. Determine:

(a) The vane angle at outlet and inlet of the runner

(b) The hydraulic efficiency

[15] (C.O.No. 3) [Application]



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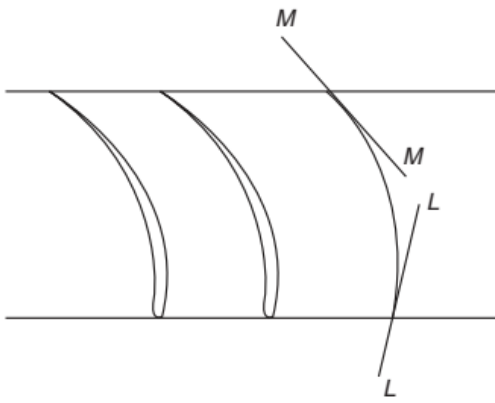


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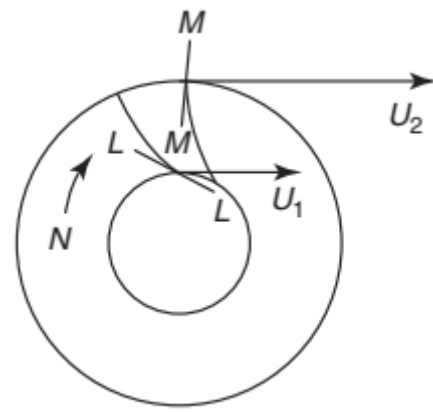


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Answer both the Questions. Each question carries FIFTEEN marks. (2Qx15M=30M)

Q.NO. 13. A Kaplan turbine produces 30,000 kW under a head of 9.6 m, while running at 65.2 rpm. The discharge through the turbine is 350 m³/s. The tip diameter of the runner is 7.4 m. The hub diameter is 0.432 times the tip diameter. Calculate (a) the turbine efficiency, (b) the specific speed of turbine, (c) the speed ratio (base on tip diameter), and (d) the flow ratio.

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(a) The vane angle at outlet and inlet of the runner

(b) The hydraulic efficiency

[15] (C.O.No. 3) [Application]