ROLL NO:	

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

PRESIDENCY UNIVERSITY, BENGALURU

SCHOOL OF ENGINEERING

Weightage: 20 % Max Marks: 40 Max Time: 1 hr. Tuesday, 25th September, 2018

TEST – 1

Odd Semester 2018-19 Course: **MEC 303 Turbomachinery** V Sem. Mechanical

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Instruction:

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

Part A

(3 Q x 4 M = 12 Marks)

1. Differentiate between turbo machine and positive displacement machine.
2. Explain Geometric, Kinematic, Dynamic similarities and effect of Reynolds number.
3. Derive Specific speed equation for turbine.

Part B

(2 Q x 8 M = 16 Marks)

4. The thrust of a propeller is assumed to depend on axial velocity of the fluid V, the density ρ and viscosity of the fluid μ, the speed in rpm N and the diameter D. Find the relationship of T by dimensional analysis.

5. A Turbomachine has inner and outer radius of 8cm and 15cm.The fluid enters at inner radius and leaves at outer radius of wheel. The fluid enters the wheel at angle of 22 degree with absolute velocity of 43m/s.The absolute velocity of fluid at rotor exit is 16m/s at angle of 36 degree from wheel tangent. The speed of rotor is 3000 RPM.Draw velocity triangle and find a) power output in kilowatt if mass flow rate is 10kg/s.

   b) Relative velocity at inlet and outlet (m/s)

   c) Blade angles

Part C

(1Q x 12 M = 12 Marks)

6. **a)** An axial flow pump with a rotor diameter of 300mm handles liquid water at the rate of 160 m^3/h while operating at 1500rpm. The corresponding head energy input is 125J/kg (gH). If a second geometrically similar pump with a diameter of 200mm operates at 3000rpm. What are it's a) Flow rate. b) Power input for first and second pumps.

   b) A turbine develops 9000KW working at a head of 30m and running at 100rpm. If the head is reduced by 12m, determine speed and power developed by the turbine.

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TEST 2

Odd Semester: 2018-19
Course Code: MEC 303
Course Name: Turbomachinery
Branch & Sem: MEC & V Sem

Date: 28 November 2018
Time: 1 Hour
Max Marks: 40.
Weightage: 20%

Instructions:

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

Part A

Answer **all** the Questions. **Each** question carries **four** marks. (3x4=12)

1. Define degree of reaction. Write expression for Degree of Reaction
2. Define Impulse Machine and Reaction Machine with two examples each
3. Find Velocity relation for 50% Reaction Turbomachine.

Part B

Answer **both** the Questions. **Each** question carries **eight** marks. (2x8=16)

4. Derive relation between Utilization Factor and Degree of Reaction
5. Derive the formulae for maximum utilization factor with appropriate velocity triangle

Part C

Answer the Question. Question carries **twelve** marks. (1x12=12)

6. At Nozzle exit at certain stage in steam turbine the absolute steam velocity is 300m/s and nozzle angle is 18^0.The rotor speed is 150m/s and rotor blade angle at outlet is 3.5^0 less then inlet blade angle. Assume $U_1=U_2$ and $V_{r1}=V_{r2}$

   Steam flow rate is 5kg/s.

   1. Draw appropriate velocity triangle(inlet and outlet)
   2. Rotor Blade angle at inlet and outlet.(β_1 and β_2)
   3. Power Output (in KW)
   4. Utilization Factor

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END TERM FINAL EXAMINATION

Odd Semester: 2018-19 | **Date**: 29 December 2018

Course Code: MEC 303 | **Time**: 2 Hours

Course Name: Turbomachinery | **Max Marks**: 80

Programme & Sem: MECH & V Sem | **Weightage**: 40%

Instructions:

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

Part A

Answer **all** the Questions. **Each** question carries **five** marks. (4Qx5M=20)

1. Define different types of Head related to Hydraulic Turbine with appropriate diagram. Also give classification of Hydraulic turbine for four different condition.
2. A Pelton wheel has blade speed(U) 10m/s with jet of water flowing at a rate of 700 litre/sec under head of 30m/s.The bucket deflect the jet through an angle of 160^0.Calculate Power in kW given by water to runner. Also draw appropriate velocity triangle for inlet and outlet. Take coefficient of velocity (C_v) as 0.98.
3. What is compounding of Steam turbine. Name different compounding which can be done in steam turbine. Explain Velocity compounding of impulse turbine with appropriate diagram.
4. What do you mean by Multistage Centrifugal Pump? Explain two function of multistage centrifugal pump with appropriate diagrams.

Part B

Answer **all** the Questions. **Each** question carries **ten** marks. (4Qx10M=40)

5. A Pelton wheel is to be designed for following specification.
   Shaft Power=11772 kW
   Net head=380m
   Speed 750 rpm
   Overall efficiency=86%
   Jet diameter is not to exceed (1/6) of wheel diameter
   Determine-a) Wheel diameter (in m)
   b) No. of jet required
   c) Diameter of jet (in m)
   Assume U/V_1=0.45
   And coefficient of velocity (C_v) as 0.985.

6. In De Laval turbine steam flows from nozzle with a velocity of 1200m/s. The nozzle angle is 20°.The mean blade speed is 400m/s. The inlet and outlet blade angles are equal. Mass flow rate of steam is 1000 kg/hr. Also ratio of relative velocity at exit upon inlet is 0.8 ($V_{r2}=0.8V_{r1}$)
   Calculate:
   a) Draw appropriate velocity triangle
   b) Blade angle at inlet and outlet
   c) Relative velocity of steam at inlet and outlet.
   d) Power developed(in kW)
7. Explain main parts of Radial flow reaction turbine with suitable diagram.
   What do you mean by Net Positive Suction Head(NPSH).
   Explain its significance with respect to centrifugal pump.
8. Give four difference between Centrifugal pump and Reciprocating pump.
   Derive expression for specific speed of turbine.

Part C

Answer **both** the Questions. **Each** question carries **ten** marks. (2Qx10M=20)

9. The penstock supplies water from a reservoir to the pelton wheel with gross head of 500m. One third of gross head is lost in friction in penstock. The rate of flow of water through the nozzle fitted at the end of penstock is 2 m^3/s. The angle of deflection of jet is 165°.
   Take speed ratio, $\frac{U}{V1}$ =0.45
   a) Draw appropriate inlet and outlet velocity triangle.
   b) Determine power given by water to runner.
   c) Define hydraulic efficiency and also find its value in percentage.

10. A hydraulic reaction turbine of radial inward type works on head of 160m. At a point of entry the rotor blade angle is 61°.The diameter of runner at inlet and outlet are 3.65 m 2.45 m respectively. If the absolute velocity at wheel outlet is radial with magnitude of 15.5 m/s and radial component of velocity at inlet is 10.3 m/s.Flow rate is 110 m^3/s.
    a) Draw appropriate inlet and outlet velocity triangle.
    b) Find power developed by machine assuming that 88% of available head of machine is converted into power.
    c) Find degree of reaction
    d) Find utilization factor.