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UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2017

Program/course: B.Tech. / Mechatronics | **Semester – VII**
Subject: Fluid Power System & Factory Automation | **Max. Marks : 100**
Code : MEEL412 | **Duration : 3 Hrs**
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Section-A

Answer all the questions. 20 M

1) Explain the following heads: [5M]

i) Manometric head
ii) Potential head
iii) Velocity head
iv) datum head

2) What is the difference between momentum equation and impulse momentum equation [5M]

3) What are impulse effect and reaction effect in a hydroturbine? Give examples. [5M]

4) Explain the need for a foot valve and strainer in a centrifugal pump system. [5M]

Section-B

Answer all the questions. 40M

5) Derive Euler's equation for work done in rotodynamic machines. State all assumptions. [10M]

6) Explain the working of a single stage centrifugal pump with sketches. [10M]

7) Draw a schematic diagram of a Kaplan turbine and explain briefly its construction and working. [10M]

8) Answer any one question out of two. [10M]

a) A 0.4m X 0.3m, 900 vertical bend carries 0.5 m3/s oil of specific gravity 0.8 with a pressure of 118kN/m2 at inlet to the bend. The volume of the bend is 0.1 m3. Find magnitude and direction of the force on the bend. Neglect friction and assume both inlet and outlet sections to be at same horizontal level. Also assume that water enters the bend at 450 to the horizontal.

b) In a 45^0 bend a rectangular air duct of $1m^2$ cross-sectional area is gradually reduced to $0.5m^2$. Find the magnitude and direction of force required to hold the duct in position if the velocity of flow at $1m^2$ section is 10m/s and pressure is $30kN/m^2$. Take the specific weight of air as $0.0116kN/m^3$

Section-C

Answer all the questions 40M

9) A Francis turbine has wheel diameter of 1m at the entrance and 0.5m at the exit. The vane angle at the entrance is 900 and the guide vane angle is 150. The water at exit leaves the vanes without any tangential velocity. The head is 30m and the radial component velocity of is constant. What would be the speed of the wheel in rpm and vane angle at exit? [20M]

10) Answer any one question out of two. [20M]

a) With the help of neat diagram explain the constructions and working of a Francis turbine. Derive an expression for hydraulic efficiency of Francis turbine

OR

b) A Pelton wheel operates with a jet of 150mm diameter under the head of 500m. Its mean runner diameter is 2.25m and it rotates with a speed of 375rpm. The angle of bucket tip at outlet as 150, Coefficient of velocity is 0.98, mechanical losses equal to 3% of power supplied and the reduction in relative velocity of water while passing through bucket is 15%. Find (a) the force of jet on the bucket, (b) the power developed (c) hydraulic efficiency and (d) the overall efficiency.