

**FOURTH SEMESTER B.TECH DEGREE EXAMINATION**  
**(2013 Scheme)**  
**13.406 FLUID MECHANICS AND HYDRAULIC MACHINES (U)**  
**MODEL QUESTION PAPER**

**Time: 3 hours**

**Maximum marks: 100**

**PART A**

*(2 marks each. All questions are compulsory)*

1. State Newtons Law of Viscosity.
2. How can you classify the pressure measuring equipments?
3. Define the terms Specific volume & Specific gravity
4. What is a Stream line & Streak line?
5. What is a "Pitot static tube"?
6. Define Reynolds Number and what is its significance?
7. What do you meant by water hammer?
8. How can you classify Hydraulic Turbines?
9. Define speed ratio and jet ratio
10. Explain the working of a vane pump?

**PART B**

*(answer one full question out of the two from each module)*

**MODULE I**

- 11. (A)** A rectangular pontoon 10m long 7 m broad & 2.5m deep weights 686.7KN. it carries on its upper deck an empty boiler of 5 m diameter weighing 588.6 KN. The centre of gravity of the boiler and the pontoon are at their respective centers along a vertical line. Find the metacentric height and check the stability of the body. Weight density of sea water is 10.104 KN/m<sup>3</sup> **15 Marks**
- (B)** State and prove hydrostatic law **5 Marks**

- 12. (A)** The diameter of a small piston and a large piston of a hydraulic jack are 3 cm & 10 cm respectively. A force of 80N is applied on the small piston. Find the load lifted by the large piston when,
- a. The pistons are at the same level
  - b. Small piston is 40cm above the large piston. Given  $\rho=1000\text{Kg/m}^3$  **15 Marks**
- (B)** State and prove pascals law **5 Marks**

**MODULE II**

- 13. (A)** A 30 cm X 15 cm venturimeter is provided in a vertical pipeline carrying oil of specific gravity 0.9, the flow being upwards. The difference in elevation of the throat section and the entrance section of the venturimeter is 30 cm. the differential U tube mercury manometer shows a gauge deflection of 25 cm. calculate:
- a. The discharge of oil
  - b. The pressure difference between the entrance section and the throat section. Take  $C_d=0.98$  & sp gravity of mercury as 13.6 **10 Marks**
- (B)** State Bernoullis theorem and derive the equation from first principle. **10 Marks**

- 14. (A)** A jet of water a velocity of 30m/s strikes a series of radial curved vanes mounted on a wheel which is rotating at 200 RPM. The jet makes an angle of  $20^{\circ}$  with the tangent to the wheel at inlet and leaves the wheel with a velocity of 5m/s at an angle of  $130^{\circ}$  to the tangent to the wheel at outlet. Water is flowing from outward in a radial direction. The outer and inner radii of the wheel are 0.5m & 0.25m respectively, find
- Vane angle at inlet and outlet.
  - Work done per unit weight of water.
  - Efficiency of wheel.
- 15 Marks**
- (B)** What do you meant by stream function and potential function? **5 Marks**

### MODULE III

- 15.** Prove that the ratio of maximum velocity to average velocity of flow of viscous fluid through pipe is 2. **20 Marks**
- 16. (A)** A laminar flow is taking place in a pipe of diameter 200mm. The maximum velocity is 1.5m/s. find the mean velocity and the radius at which this occur. Also calculate the velocity at 4cm from the wall of the pipe. **10 Marks**
- (B)** A 150 mm diameter pipe reduces in diameter abruptly to 100mm diameter. If the pipe carries water at 30lit/sec, calculate the pressure loss across the contraction. Take the coefficient of contraction as 0.6. **10 Marks**

### MODULE IV

- 17. (A)** The penstock supplies water from a reservoir to the Pelton Wheel with a gross head of 500m. One third of the gross head is lost in friction in penstock. The rate of flow of water through the nozzle fitted at the end of the penstock is  $2\text{m}^3/\text{S}$ . The angle of deflection of jet is  $165^{\circ}$ . Determine the power given by the water to the runner and also hydraulic efficiency of the Pelton Wheel. Take speed ratio =0.45 &  $C_v=1$ . **15 Marks**
- (B)** How can you classify centrifugal pumps **5 Marks**
- 18. (A)** A Kaplan Turbine is to be designed to develop 9100KW. The net available head is 5.6m. If the speed ratio= 2.09, flow ratio = 0.68, overall efficiency =86% and the diameter of Boss is 1/3 the diameter of runner. Find the diameter of runner, its speed and the specific speed of the turbine. **15 Marks**
- (B)** Explain the effect of friction in suction & delivery pipe of a reciprocating pump with the help of an indicator diagram. **5 Marks**