ANNA UNIVERSITY OF TECHNOLOGY, COIMBATORE

B.E. / B.TECH. DEGREE EXAMINATIONS : NOV / DEC 2011

REGULATIONS : 2008

THIRD SEMESTER

080180007 - FLUID MECHANICS AND MACHINERY

(COMMON TO AERONAUTICAL / AUTOMOBILE / MECHANICAL / PRODUCTION ENGG.)

Time: 3 Hours **Max. Marks : 100**

PART - A

(10 x 2 = 20 Marks)

ANSWER ALL QUESTIONS

1. Distinguish between solid and fluid
2. Define (a) Kinematic viscosity (b) Dynamic viscosity
3. Differentiate between laminar and turbulent flow
4. Define boundary layer thickness
5. Define the terms (a) Dimensional analysis (b) Model analysis
6. What do you mean by dimensionless numbers? Name any four dimensionless numbers.
7. How is specific speed of a turbine defined?
8. What is the role of a volute chamber of a centrifugal pump?
9. What is an air vessel in reciprocating pump?
10. Define specific speed of a centrifugal pump

PART - B

(5 x 16 = 80 Marks)

ANSWER ALL QUESTIONS

11. (a) Calculate the capillary effect in millimeters in a glass tube of 4 mm diameter, when immersed in (1) water and (2) mercury the temperature of the liquid is 20°C and the values of surface tension of water and mercury at 20°C in contact with air are 0.0735 N/m and 0.51 N/m respectively. The contact angle of water $\theta = 0$ and for mercury $\theta = 130°$. Take specific weight of water at 20°C as for equal to 9790 N/m^3 and specific gravity of mercury is 13.6

(OR)

(b) Derive Euler's equation of motion along a stream line for an ideal fluid stating clearly the assumptions. Explain how this is integrated to get Bernoulli's equation along a stream line.

12. a) A horizontal pipe line 40 m long is connected to a water tank at one end and discharges freely into the atmosphere at the other end. For the first 25 m of its length from the tank, the pipe is 150 mm diameter and its diameter is suddenly enlarged to 300 mm. The height of water level in the tank is 8 m above the centre of the pipe. Considering all losses of head, determine the rate of flow. Take f= 0.01 for both sections of the pipe.

(OR)

12. (b) Three pipes of 400 mm, 200 mm and 300 mm diameters have lengths of 400 m, 200 m, and 300 m respectively. They are connected in series to make a compound pipe. The ends of this compound pipe are connected with two tanks whose difference of water levels is 16 m. If coefficient of friction for these pipes is same and equal to 0.005, determine the discharge through the compound pipe neglecting first the minor losses and then including them

13. (a) The efficiency η of a fan depends on density ρ, dynamic viscosity μ of the fluid, angular velocity ω, diameter D of the rotor and the discharge Q. Express η in terms of dimensionless parameters.

(OR)

(b) (i) State Euler's model law (4)

(ii) The pressure drop in an aero plane model of size 1/10 of its prototype is 80 N/cm^2. The model is tested in water. Find the corresponding pressure drop in the prototype. Take density of air = 1.24 kg/m^3. The viscosity of water is 0.01poise while the viscosity of air is 0.00018 poise. (12)

14. (a) (i) Define cavitation. What are the effects of cavitation? Give the necessary precautions against cavitation. (6)

(ii) With a neat sketch, explain the principle and working of a centrifugal pump (10)

(OR)

(b) An inward flow reaction turbine has external and internal diameters as 1.0 m and 0.6 m respectively. The hydraulic efficiency of the turbine is 90% when the head on the turbine is 36 m. The velocity of flow at outlet is 2.5 m/s and discharge at outlet is radial. If the vane angle at outlet is 15° and width of the wheel is 100 mm at inlet and outlet, determine (i) the guide blade angle, (ii) speed of the turbine, (iii) vane angle of the runner at inlet, (iv) volume flow rate of turbine and (v) power developed.

15. (a) What is a reciprocating pump? Describe the principle and working of a reciprocating pump with a neat sketch. Why is a reciprocating pump not coupled directly to the motor? Discuss the reason in detail

(OR)

(b) A single acting reciprocating pump, has a plunger of 100 mm diameter and a stroke length 200 mm. The centre of the pump is 3 m above the water level in the sump and 20 m below the water level in a tank to which water is delivered by the pump. The diameter and length of suction pipe are 50 mm and 5 m while that of the delivery pipe are 40 mm and 30 m respectively. Determine the maximum speed at which the pump may be run without separation, if separation occurs at 7.3575 N/cm^2 below the atmospheric pressure. Take atmospheric pressure head = 10.3 m of water.

*******THE END*******