Reg. No. : | | | | | | | | | | | |

# L 1140

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2008.

Third Semester

Mechanical Engineering

CE 253 — FLUID MECHANICS AND MACHINERY

(Common to Mechatronics Engineering)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is the difference between cohesion and adhesion?
2. What do you mean by surface tension?
3. How are fluid flows classified?
4. List the assumptions which are made while deriving Bernoulli's equation.
5. What is an equivalent pipe?
6. Write the formula for calculating loss of head due to

   (a) Sudden enlargement (b) Sudden contraction.
7. Write down the uses of dimensional analysis.
8. What are the applications of model testing?
9. Define Specific speed of a turbine.
10. Draw the Ideal indicator diagram.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Determine the mass density, weight density and specific volume of a liquid whose Relative density is 0.85 (6)

    (ii) A Liquid of 10 litres with Relative density of 1.30 is mixed with 8 litres of a liquid of Relative density 0.80. If the bulk of the liquid shrinks one percent on mixing, calculate the relative density, the density, the volume and weight of the mixture. (10)

Or

(b) (i) A block of base area 200 $cm^2$, weight 100 N slides down 20° inclined plane, over an oil film of 1 mm of thickness and dynamic viscosity of 500 poise. Estimate the velocity of the block. (10)

(ii) A U-tube is made of two capillaries of bore 1 mm and 2 mm respectively and is partially filled with liquid of surface tension 0.05 N/m and zero contact angle. Calculate the mass density of the liquid if the estimated difference in the level of two meniscii is 12.5 mm (6)

12. (a) (i) Water is flowing through a pipe having diameters 600 mm and 400 mm at the bottom and upper end respectively. The intensity of pressure at the bottom end is 350 Kpa and the pressure at the upper end is 100 Kpa. Determine the differencing datum head if the quantity of liquid passing through the pipe is 60 lit/sec. (6)

(ii) A fireman must reach a window 40 m above the ground with a water jet, issued form a nozzle 30 mm in diameter and discharging 30 kg/sec assuming the nozzle height to be 2 m above the ground, determine the greatest horizontal distance from the building where the fireman can stand and still reach the jet the window. (10)

Or

(b) (i) Water enters a reducing pipe horizontally and comes out vertically in the downward direction, If the inlet velocity is 5 m/sec and pressure is 80 Kpa (gauge) and the diameters at the entrance and exit sections are 300 m and 200 m respectively. Calculate the components of the reaction acting on the pipe. (6)

(ii) Derive from the first principle the Euler's equation of motion for steady flow along a stream line. Obtain Bernoulli's equation from Euler's equation. (10)

13. (a) (i) Oil of absolute viscosity 1.5 poise and density 848.3 $kg/m^3$ flows through a 300 mm pipe. If the head loss in 3000 m length of pipe is 200 m, assuming a laminar flow, determine the following

(1) The velocity

(2) Reynolds number. (6)

(ii) For sudden expansion in a pipe flow, work out the optimum ratio between the diameter of the before expansion and the diameter of the pipe after expansion so that pressure rise is maximum. (10)

Or

(b) (i) A pipe line 2000 m long is used for power transmission. 110 kw is to be transmitted through the pipe in which water having a pressure of 5000 $kN/m^2$ at inlet is flowing. If the pressure drop over a length of pipe is 1000 $kN/m^2$ and coefficient of friction is 0.0065, find the diameter of the pipe and efficiency of transmission. (6)

(ii) Three pipes of diameters 300 mm, 200 mm and 400 mm and lengths 300 m, 170 m and 210 m respectively are connected in series. The difference in water surface levels in two tanks is 12 m. Determine the rate of flow if co-efficient of friction are 0.005, 0.0052 and 0.0048 respectively considering

(1) Minor losses, and

(2) Neglecting minor losses. (10)

14. (a) (i) Determine the dimensions of the following quantities:

Discharge, Kinematic viscosity, Force and Specific weight (6)

(ii) What are distorted models? What are the merits and demerits of distorted models? (10)

Or

(b) State Buckingham's $\pi$ theorem and describe how the Buckingham's method differ from Raleigh's method. (16)

15. (a) (i) With the help of a neat sketch, describe the components of a pelton wheel. (6)

(ii) A Single acting Reciprocating Pump has a plunger of diameter 300 mm and stroke of 200 mm. If the speed of the pump is 30 rpm and the actual discharge is 6.5 litres per second of water, find the coefficient of discharge and percentage slip if overall efficiency is 75 %. What horse power is required to drive the pump. If the suction lift is 4 m and delivery head is 30 m. (10)

Or

(b) (i) What are the effects of Cavitations? Give the necessary precautions against cavitations. (6)

(ii) What are the functions of a draft tube?

The following data refers to an inward flow reaction turbine:

Supply 1.2 Cumecs at 30 m head.

Wheel diameter = 750 mm at outlet and 500 mm at inlet.

Radial exit velocity = 2.4 m/sec.

Inlet vane angle = 35°

Calculate the HP and RPM of the turbine. Assume the width of the wheel as constant and turbine efficiency is 80%. (10)