Reg.No.										

MANIPAL INSTITUTE OF TECHNOLOGY
(A Constituent Institute of MAHE –Deemed University)
Manipal – 576 104

III SEMESTER B.E. (MANUFACTURING ENGG.) DEGREE (MAKE-UP) EXAMINATIONS JAN. 2007

SUBJECT : FLUID MECHANICS AND MACHINERY.(MME-223)

(REVISED CREDIT SYSTEM)

(09/01/2007)

Time: 3 Hours. MAX.MARKS: 50

Instructions to Candidates:

- Answer **ANY FIVE** full questions.
- All questions carry equal marks.
- Missing data, if any, may suitably be assumed.
- Draw neat sketches wherever necessary.

1A) With a neat sketch explain the working principle of Orifice meter and derive the discharge equation. (04)

1B) Define and derive the following dimensionless numbers:
i) Euler's number
ii) Reynold's number. (03)

1C) Distinguish between the followings (at least two distinguishing features)
(i) Major losses and Minor losses in pipe flow (ii) Newtonian and Non-Newtonian fluid. (iii) Uniform flow and non-uniform flow. (03)

2A) Lateral stability of a long shaft 150mm in diameter is obtained by means of a 250mm stationary bearing having an internal diameter of 150.25 mm. If the space between bearing and shaft is filled with a lubricant having a viscosity 0.245 Ns/m^2, what power will be required to over come the viscous resistance when the shaft is rotated at a constant rate of 180 rpm? (04)

2B) Derive the formulae for hydrostatic force and depth of centre of pressure on concave side of a thin curved plate submerged in a liquid. (03)

2C) A square plate 4 m x 4m hangs in water from one of its corners and its centroid lies at a depth of 8m from the free surface of water. Workout the total pressure on the plate and locate the position of centre of pressure with respect to the plate centroid. (03)

3A) A cylinder has a diameter 0.5m and a specific gravity of 0.6. Calculate the maximum permissible length in order that it may float in kerosene of specific gravity 0.857, with its axis vertical. (04)

3B) Derive Darcy-Weisbach equation for head loss due to friction in pipes. (04)

3C) Explain the followings:
a) Vena contracta
b) Depth of centre of pressure. (02)

4A) Sketch and explain the working of Kaplan turbine with draft tube in position. (03)

4B) Two reservoir are connected by a pipe line consisting of two pipes in series. One pipe of 15cm diameter having length of its is 6m and other 22.5cm diameter of 16 m length. The difference in water level at free surface between the two reservoir is 6m. Calculate the discharge through the pipe. The friction factor, f = 0.04 for both pipes. (05)

4C) Verify weather the continuity equation is satisfied or not with the following velocity components.
i) $u = x^2y$; $V = 2yz - xy^2$ and $w = x^2 - z^2$
ii) $u = (a_1x + b_1y + c_1z)$; $V = (a_2x + b_2Y + c_2z)$ and
$W = (a_3x + b_3y + c_3z)$ (02)

5A) With the help of a neat and proportionate sketch, explain the principle and operation of the followings:
a) Axial flow roto-dynamic pump (b) Centrifugal pump. (06)

5B) The resistance 'R' experienced by a partially submerged body depends upon the velocity 'V', length of the body 'L', viscosity of the fluid 'μ', density of the fluid 'ρ' and gravitational acceleration 'g'. Obtain a dimensionless expression for 'R'. (04)

6A) A pipe enlarges from a diameter of 10 cm at "A" to 20 cm at "B" which is 2m higher than "A". If the discharge of water through the pipe is 150 litre/s with pressure of 6.867×10^4 N/m^2 at "A". Find the pressure at "B" . Assuming gradual enlargement of pipe and the loss of head between "A" and "B" to be 1/8th of velocity head at "A". What is the criteria for to indicate the direction of flow of fluid. (04)

6B) If 5.27 m^3 of a certain oil weight 44 kN. Calculate the specific weight, mass density and specific gravity of oil. (03)

6C) A 2.5m ship model was tested in fresh water (ρ=1000 kg/m^3) and measurements indicated that there was a resistance of 45 N when the model was moved at 2 m/s. Work out the velocity of 40 m prototype. Also calculate the force required to drive the prototype at this speed through sea water ($\rho = 1025 kg/m^3$). (03)