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B. Tech. 4th Semester (ME) F. Scheme Examination, May–2014

FLUID MECHANICS

Paper–ME–208-F

Time allowed : 3 hours] *[Maximum marks : 100*

Note : *Attempt **five** questions by selecting at least **one** from each section with **Q. No. 1 is compulsory.***

1. (i) Classify fluids.

(ii) What do you mean by specific gravity.

(iii) What is the condition for stability of floating bodies.

(iv) What do you mean by the impulse momentum principle.

(v) Define Cd, Cv, and Cc, with their relations between them.

(vi) What are the model laws and their significance.

(vii) What are the various losses in pipe flow.

(viii) What is the difference between nozzle and diffuser.

(ix) What do you mean by streamlined and bluff bodies.

(x) Give relation between shear stress and pressure gradient when one plate is moving and other is fixed. 20

Section–A

2. (a) A pontoon of 1500 tonnes displacement is floating in water. A weight of 20 tonnes is moved through a distance of 6m across the deck of the pontoon, which tilts the pontoon through an angle of 5 degrees. Find metacentric height of the pontoon. 10

(b) Derive an expression for the depth of centre of pressure from free surface of liquid of an inclined plane surface submerged in the liquid. 10

3. (a) A velocity potential for a two dimensional flow is given by the expression $\Phi = x^2 - y^2$. Determine : (i) Velocity components in the x and y directions. Check to see whether the velocity components satisfy the conditions of flow continuity and irrotationality (ii) Stream function and flow rate between the stream lines (1,0) and (1,1). Also show that streamlines and potential lines interesect orthogonally at the point (1,1). 15

(b) Derive the relation for circulation. 5

Section–B

4. (a) Derive Bernoulli's equation for fluid flow from the first principle. 10

(b) An internal mouthpiece of 100mm diameter is discharging water under a constant head of 5m. Find the discharge through mouthpiece, when

(i) mouthpiece is running free

(ii) mouthpiece is running full. 10

5. Write short notes on :

(a) Isentropic flow through nozzle. 10

(b) Propagation of elastic waves due to compression of waves. 10

Section–C

6. (a) Derive Hagen-Poiseuilli law for a pipe flow. 10

(b) Derive Darcy Weisbach equation for head loss lost due to friction. 10

7. (a) Derive expression for shear stress for flow of fluid between two plates with one plate is fixed and other is moving. 10

(b) Derive the relation for power absorbed in foot step bearing. 10

Section–D

8. (a) What are the different methods of preventing the separation of boundary layers ? 10

   (b) Derive relation for energy and momentum thickness for boundary layer. 10

9. A smooth pipe of diameter 300 mm and length 600m carries water at a rate of 0.04 m^2 /s. Determine the head lost due to friction, wall shear stress, centre line velocity and thickness of laminar sub layer. Take kinematic viscosity of water as 0.018 stokes. 20