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B.E./B.Tech. DEGREE EXAMINATIONS, NOV/DEC 2010.

THIRD SEMESTER

CIVIL ENGINEERING

CE35— MECHANICS OF FLUIDS

(Assume suitable data if necessary)

(REGULATIONS 2008)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. A 2mm diameter clean glass tube is inserted in water at 15°C.determine the height that the water will climb up the tube. The water makes a contact angle of 0° with the clean glass?

2. A tank with a volume of 0.2 m³ contains 0.5kg of nitrogen. The temperature is 20°C.What is the pressure?

3. The specific weight and the specific gravity of a body of unknown composition are deserved Its weight in air is found to be 1000N and in water it weight 750N?

4. Define Flow net?

5. What is Poiseuille flow?

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pressure rise of 400kPa.A model with an 8 cm diameter impeller is to be used. What flow rate should be used is to be expected. The model fluid is water at the same temperature as the water in the prototype?

Or

(b) Write in detail about the Buckingham π Theorem?

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6. Water at 10°C is flowing in a thin sheet in a parking lot at a depth of 5mm, with an average velocity of 0.5 m/s. Is the flow laminar or turbulent?

7. Write a short note on "separation point"?

8. Show that the streamlines and equipotential lines of a plane, incompressible, potential flow intersect one another at right angles?

9. A 1:10 scale model of an automobile is used to measure the drag on a proposed design. It is to simulate a prototype speed of 90km/h, what speed should be used in the wind tunnel if Reynolds numbers are equated? For this condition, what is the ratio of drag forces?

10. List out the Dimensionless parameters used in Fluid mechanics?

PART B — (5 × 16 = 80 marks)

11. (a) A Cylinder fitted with a piston has an initial volume of 0.5m³.It contains 2.0 kg of air at 400kPa absolute. Heat is transferred to the air while the pressure remains constant until the temperature is 300°C. Calculate the heat transfer and work done.

Or

(b) Write in detail about the continuum view of gases and liquids ?

12. (a) A 0.25 mm diameter cylinder is 0.25 m long and composed of materials with specific weight 8000 N/m³.Will it float in water with the ends horizontal ?

Or

(b) Explain in detail about the classification of fluid flows?

13. (a) A 1m diameter concrete pipe transports 20°C water at a depth of 0.4 m .If the slope is 0.001.Find the flow using the Darcy-Weisbach Equation?

Or

(b) Write in detail about the application of momentum equation to propellers ?

14. (a) Derive an expression for velocity distribution between horizontal, concentric pipes for a steady, incompressible developed flow ?

Or

(b) Estimate the boundary layer thickness at the end of a 4m long flat surface if the free stream velocity is 5m/s.Use atmospheric air at 30°C.Also predict the drag force if the surface is 5m wide. Neglect the laminar portion of the flow and $Re_{crit} = 5 \times 10^5$?

15. (a) A test is to be performed on a proposed design for a large pump that is to deliver 1.5 m³/s of water from a 40 cm diameter impeller with a