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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Fourth Semester B.Tech Degree (S, FE) Examination January 2024 (2015 Scheme)



Course Code: ME200

Course Name: FLUID MECHANICS AND MACHINERY (MC, SF)

Max. Marks: 100

Duration: 3 Hours

PART A

Answer any three questions. Each question carries 10 marks.

- 1 a) Write and explain the fluid property behind the following natural phenomena: (4)
 - i) Insects can walk freely on water surface.
 - ii) Moving ground water from wet areas of soil to dry areas.
- b) A plate weighing 150 N and measuring 0.8 m x 0.8 m slides down an inclined plane over an oil film 1.2 mm thickness for an inclination of 30° and a velocity of 0.2 m/s. Compute the viscosity of the fluid. (6)
- 2 a) What is a non-Newtonian fluid? How does it differ from a Newtonian fluid? Give one example for each. (4)
- b) Explain the phenomenon of capillarity. Obtain the expression for capillary rise of a liquid. (6)
- 3 a) What is metacentre? Explain the equilibrium conditions of floating bodies with respect to metacentric height. (4)
- b) In a hydraulic jack, the diameter of small and large pistons is 2 cm and 10 cm respectively. If the force applied on small piston is 1000 N, find the load lifted by the large piston when:
 - i) Both the pistons are at same levels.
 - ii) Small piston is 5 mm above the large piston.Take specific gravity of the oil as 0.8. (6)
- 4 An inclined rectangular gate 4 m wide and 1 m deep has been installed to control the discharge of water. The upper end is hinged and lies at a distance of 2 m from the free surface of water. What force normal to the gate is applied at the lower end to open it. (10)

PART B

Answer any three questions. Each question carries 10 marks

- 5 Differentiate the following: (10)
- i) Steady and unsteady flow ii) Uniform and non-uniform flow
 iii) Rotational and irrotational flow iv) Laminar and turbulent flow
 v) 2-D and 3-D flow
- 6 a) Differentiate between venturimeter and orifice meter. (4)
 b) An oil of specific gravity 0.85 flows through a horizontal pipe of diameter 20 cm. (6)
 A pitot tube is inserted at the centre of the pipe and its leads are filled with the same oil and attached to a U-tube containing water. The reading on the manometer is 15 cm. Determine the quantity of oil flowing through the pipe. Take the coefficient of the pitot tube as unity.
- 7 An oil of specific gravity 0.7 is flowing through a pipe of diameter 300 mm at the (10)
 rate of 500 litre/s. Find the head loss due to friction and power required to maintain the flow for a length of 1 km. Take kinematic viscosity as 0.29 stokes.
- 8 a) What is meant by: (6)
 i) Displacement thickness
 ii) Momentum thickness
 iii) Energy thickness
 b) Explain the phenomenon of separation of boundary layer. (4)

PART C

Answer any four questions. Each question carries 10 marks.

- 9 a) Differentiate between impulse and reaction turbines. (4)
 b) With neat sketch explain the constructional features of Pelton turbine. (6)
- 10 A Pelton wheel is to be designed for the following data. The power to be (10)
 developed = 6000 kW. Net head available = 300 m. Speed = 550 rpm. Ratio of jet diameter to wheel diameter = 1/10. Overall efficiency = 80%. Find the number of jets, diameter of the jet, diameter of the wheel and the quantity of water required.
- 11 a) What is draft tube? What are the different types? Explain its function in turbines. (6)
 b) Explain the cavitation phenomenon in turbines. (4)
- 12 a) With neat sketch explain the components and working of centrifugal pump. (7)
 b) What is priming? What is the purpose of doing it. (3)

- 13 a) Explain the single acting and double acting reciprocating pumps with sketches. (6)
- b) What is slip in pumps? Explain the causes of negative slip in reciprocating pump. (4)
- 14 A multistage centrifugal pump is to be installed to lift water through a head of 80 m at the rate of $0.1 \text{ m}^3/\text{s}$. The pump is coupled to an electric motor running at 1000 rpm. Make calculations for the head developed per stage and the required number of stages; the required impeller diameter if the speed ratio based on impeller diameter is 0.9 and power required. Assume that the overall efficiency is 0.75 and the specific speed of each impeller is 30. (10)