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Question Paper Code : 23842

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2018.

Fourth Semester

Mechanical Engineering

ME 2204/CE 3213 — FLUID MECHANICS AND MACHINERY

(Common to Manufacturing Engineering/Industrial Engineering and
Management/Aeronautical Engineering/Automobile Engineering/Industrial
Engineering/Mechanical and Automation Engineering/Mechatronics Engineering
and Production Engineering)

(Regulations 2008)

(Also common to PTME 2204 – Fluid Mechanics and Machinery for B.E. (Part-Time)
Third Semester – Mechanical Engineering — Regulations 2009)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define Compressibility.
2. Distinguish between ideal fluid and real fluid.
3. Give the reason for minor energy losses in pipes.
4. What is meant by hydraulic gradient line?
5. What are the different laws on which models are designed for dynamic similarity?
6. How will you determine the total drag of a ship or partially submerged bodies?
7. Differentiate between the turbines and pumps.
8. Define hydraulic efficiency.
9. What is an air vessel?
10. What is negative slip in a reciprocating pump?

PART B— (5 × 16 = 80 marks)

11. (a) An oil film thickness 1.5 mm is used for lubrication between a square plate of size 0.9 m × 0.9 m and an inclined plane having an angle of inclination 20°. The weight of the square plate is 40 kgf and it slides down the plane with a uniform velocity of 0.2 m/sec, Find the dynamic viscosity of oil. (16)

Or

- (b) A piston 796 mm diameter and 200 mm long works in a cylinder of 800 mm diameter. If the annular space is filled with a lubricating oil of viscosity 5cp (centi-poise), calculate the speed of descent of the piston in vertical position. The weight of the piston and axial load are 9.81 N. (16)
12. (a) Two reservoirs are connected by a pipeline of diameter 60 cm and length 4000 m. The difference of water level in the reservoirs is 20 m. At a distance of 1000 m from the upper reservoir, a small pipe is connected to the pipeline. The water can be taken from the small pipe. Find the discharge to the lower reservoir, if
- (i) No water is taken from the small pipe, and
- (ii) 100 litres/sec of water is taken from small pipe.
- Take $f = 0.005$ and neglect minor losses. (16)

Or

- (b) A pipe line 60 cm diameter bifurcates at a Y-junction into two branches 40 cm and 30 cm in diameter. If the rate of flow in the main pipe is 1.5 m³/sec and mean velocity of flow in 30 cm diameter pipe is 7.5 m³/sec, determine the rate of flow in the 40 cm diameter pipe. (16)
13. (a) Explain the procedure for solving problems by Buckingham's π -theorem. (16)

Or

- (b) Explain the different types of hydraulic similarities that must exist between the prototype and its model. (16)
14. (a) A pelton turbine develops 3000 kW under a head of 300 m. The overall efficiency of the turbine is 83%. If the speed ratio = 0.46, $C_v = 0.98$ and specific speed is 16.5. then find :
- (i) Diameter of the turbine, and
- (ii) Diameter of the jet. (16)

Or

- (b) The internal and external diameters of the impeller of a centrifugal pump are 20 cm and 40 cm respectively. The pump is running at 1200 rpm. The vane angles of the impeller at inlet and outlet are 20° and 30° respectively. The water enters the impeller radially and velocity of flow is constant. Determine the work done by the impeller per kg of water. (16)

15. (a) The cylinder bore diameter of a single stage acting reciprocating pump is 150 mm and its stroke is 300 mm. The pump runs at 50 rpm and it lifts water through a height of 25 m. The delivery pipe is 22 m long and 100 mm in diameter. Find the theoretical discharge and the theoretical power required to run the pump. If the actual discharge is 4.2 litres/sec, find the percentage slip. Also determine the acceleration head at the beginning and middle of the delivery stroke. (16)

Or

- (b) (i) Describe the working principles of an air vessel with a neat sketch. (8)
- (ii) State and advantages and limitations of a rotary pump. (8)