Code No: R21021

R10

SET - 1

II B. Tech I Semester Regular Examinations, March – 2014
FLUID MECHANICS AND HYDRALICS MACHINES
(Com. to EEE, ME, MM)

Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions
All Questions carry **Equal** Marks
~~~~~~~~~~~~~~~~~~~~~~~~~

1. a) Differentiate between; i) Absolute and gauge pressure, ii) simple manometers and differential manometers, and iii) Piezometer and pressure gauge.
   b) Two large vertical plane parallel surfaces are 5 mm apart and the space between them is filled with a fluid. A thin plate of 12.5 cm square falls freely between the planes along the central plane and reaches a steady velocity of 2 m/s. Determine the weight of the plate if the viscosity of the fluid filling the space is 0.02 Ns/m^2. (9M+6M)

2. a) What is meant by one-dimensional, two-dimensional and three- dimensional flows?
   b) Distinguish between:
   i) Steady flow and un-steady flow ii) Uniform and non-uniform flow
   iii) Compressible and incompressible flow iv) Laminar and turbulent flow (7M+8M)

3. a) A horizontal venturimeter with inlet diameter 20 cm and throat diameter 10 cm is used to measure the flow of water. The pressure at inlet is 17.658 N/cm^2 and the vacuum pressure at the throat is 30 cm of mercury. Find the discharge of water through venturimeter. Take C_d=0.98.
   b) Explain various minor losses in pipes. (8M+7M)

4. a) Derive the expression for the force exerted by a water jet on a plate moving in the same direction of the jet with a velocity less than that of the jet.
   b) A blade turns the jet of diameter 3 cm at a velocity of 20 m/s by 60°. Determine the force exerted by the blade on the fluid. (9M+6M)

5. a) Explain how hydropower plants are classified
   b) How do you estimate hydropower potential? (10M+5M)

6. What do you understand by the characteristics curves of turbine? Name and explain the important characteristics curves of a turbine. (8M+7M)

7. a) What is meant by 'cavitation'? What is Thoma's cavitation factor, and what is its significance for water turbines?
   b) What are the characteristics curves of a hydraulic turbine? How are they useful to practical engineer? (8M+7M)

8. a) What are the different efficiencies of centrifugal pump
   b) Draw and discuss the operating characteristics of a centrifugal pump (7M+8M)
~~~~~~~~~~~~~~~~~~~~~~~~~

Code No: R21021 **R10** SET - 2

II B. Tech I Semester Regular Examinations, March – 2014
FLUID MECHANICS AND HYDRALICS MACHINES
(Com. to EEE, ME, MM)

Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions
All Questions carry **Equal** Marks
~~~~~~~~~~~~~~~~~~~~~~~~~

1. a) Two large planes are parallel to each other and are inclined at 30° to the horizontal with the space between them filled with a fluid of viscosity 20 cp. A small thin plate of 0.125 m square slides parallel and midway between the planes and reaches a constant velocity of 2 m/s. The weight of the plate is 1 N. Determine the distance between the plates.
   b) Derive expressions from basics for the pressure inside a droplet and a free jet. (8M+7M)

2. a) Explain the following:
   i) Path line, ii) Streak line, iii) Stream line, and iv) Stream tube.
   b) Define the equation of continuity. Obtain an expression for continuity equation for a three dimensional flow. (8M+7M)

3. a) Show that the velocity profile in laminar flow through a circular pipe is parabolic. Find the average velocity in terms of maximum velocity.
   b) Describe Reynolds experiments to demonstrate the two types of flow (8M+7M)

4. A 4 cm diameter water jet with a velocity of 35 m/s impinges on a single vane moving in the same direction at a velocity of 20 m/s. The jet enters the vane tangentially along the x direction. The vane deflects the jet by 150°. Calculate the force exerted by the water on the vane. (15M)

5. a) What do you mean by mass curve
   b) How do you estimate power developed from a given catchment area. (5M+10M)

6. a) What are the uses of a draft tube? Describe with neat sketches different types of draft tubes.
   b) A model of Francis turbine one-fifth of full size, develops 4.1 h.p at 306 r.p.m. under a head of 1.77 m. Find the speed and power of full size turbine operating under a head of 5.7 m, if i) the efficiency of the model and the full size turbine are same, ii) the efficiency of the model turbine is 76 % and the scale effect is considered. (8M+7M)

7. Explain: a) Unit speed, b) Unit discharge, c) Unit power of a hydraulic turbine. Derive expressions for each of them. (15M)

8. a) Under what headings the centrifugal pumps are classified? State the difference between a closed, semi closed and open impeller.
   b) Explain the working principles of reciprocating pump with sketches (7M+8M)
~~~~~~~~~~~~~~~~~~~~~~~~~

Code No: R21021 **R10** SET - 3

II B. Tech I Semester Regular Examinations, March – 2014
FLUID MECHANICS AND HYDRALICS MACHINES
(Com. to EEE, ME, MM)

Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions
All Questions carry **Equal** Marks
~~~~~~~~~~~~~~~~~~~~~~~~~

1. a) A shaft of 150 mm dia rotates in bearings with a uniform oil film of thickness 0.8 mm. Two bearings of 15 cm width are used. The viscosity of the oil is 22 Centipoise. Determine the torque if the speed is 210 rpm.
   b) What is the difference between dynamic viscosity and kinematic viscosity? State their units of measurements. (10M+5M)

2. a) A bend in pipeline conveying water gradually reduces from 60 cm to 30 cm diameter and defects the flow through angel of 60°. At the larger end the gage pressure is 1.75 kg/cm^2. Determine the magnitude and direction of the force exerted on the bend, when flow is 876 liters per sec
   b) What are different energies of a fluid? Explain each of them. (9M+6M)

3. a) Derive an expression for the velocity distribution for viscous flow through a circular pipe. Also sketch the velocity distribution and shear distribution across a section of the pipe
   b) Define and explain the terms: i) Hydraulic gradient line and ii) Total energy line (9M+6M)

4. a) Obtain an expression for the force exerted by a jet of water on a fixed vertical plate in the direction of the jet.
   b) A blade turns the jet of diameter 2 cm at a velocity of 15 m/s by 65°. Determine the force exerted by the blade on the fluid. (9M+6M)

5. a) Describe the concept of pumped storage plants
   b) What are the various components of hydro power plants. Describe each briefly. (9M+6M)

6. a) Explain briefly the principles on which a Kaplan turbine works
   b) Estimate the maximum height of straight conical draft tube of 18000 h.p. Francis turbine running at 150 r.p.m. under a net head of 27 m. The turbine is installed at a station where the effective atmospheric pressure is 10.6 m of water. The draft tube must sink at least 0.77 m below the tail race. (8M+7M)

7. a) Brefly explain the various considerations in the selection of a proper type of turbine for a hydroelectric station, indicating also the conditions where a particular type of turbine is suitable.
   b) What do you understand by governing of hydraulic turbines? Explain with sketches the working of an oil pressure governor. (8M+7M)

8. a) What do you mean by manometric efficiency, mechanical efficiency and overall efficiency of centrifugal pump.
   b) Define slip, percentage slip and negative slip of reciprocating pump. (9M+6M)
~~~~~~~~~~~~~~~~~~~~~~~~~

Code No: R21021 **R10** SET - 4

II B. Tech I Semester Regular Examinations, March – 2014
FLUID MECHANICS AND HYDRALICS MACHINES
(Com. to EEE, ME, MM)

Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions
All Questions carry **Equal** Marks
~~~~~~~~~~~~~~~~~~~~~~~~~

1. a) A U- tube mercury manometer is used to measure the pressure of oil flowing through a pipe whose specific gravity is 0.85. The center of the pipe is 15 cm below the level of mercury. The mercury level difference in the manometer is 25 cm, determine the absolute pressure of the oil flowing through the pipe. Atmospheric pressure is 750 mm of Hg.
   b) State and prove Pascal's law. Explain the consequences of the law. (9M+6M)

2. a) Define and distinguish between streamline, path line and streak line.
   b) State and derive Bernoulli's theorem, mentioning clearly the assumption underlying it. (6M+9M)

3. a) An oil of specific gravity 0.7 is flowing through a pipe of diameter 300 mm at the rate of 500 liters/s. Find the head lost due to friction and power required to maintain the flow for a length of 1000 m. Take $\nu = 0.29$ stokes.
   b) What do you understand by the terms: major energy loss and minor energy losses in pipes? (9M+6M)

4. A water jet with a velocity of 60 m/s enters a series of curved vanes at an angle of 20° to the direction of blade movement. The peripheral speed of the disc on which the blades are mounted is 25 m/s. Calculate the vane inlet angle. If at the exit the component of absolute velocity along the direction of motion is zero, determine the outlet blade angle. Assume shockless enters and exit. (15M)

5. a) Make a neat sketch of a hydropower plant and show clearly the various elements.
   b) How do you estimate hydropower potential (10M+5M)

6. a) Draw a neat sketch of Pelton turbine and Francis turbine.
   b) What are unit quantities? Define the unit quantities for turbine. (8M+7M)

7. Explain the terms 'specific speed', 'unit speed' and 'unit power' as applied to hydraulic turbines. Deduce expressions to indicate their values. (15M)

8. What is a reciprocating pump? Describe the principle and working of a reciprocating pump with a neat sketch. Why is a reciprocating pump not coupled directly to the motor? Discuss the reason in detail (15M)
~~~~~~~~~~~~~~~~~~~~~~~~~