Jharsuguda Engineering School (JES), Jharsuguda

Department of Mechanical Engineering

Subject/Semester: Hydraulic Machines & Industrial Fluid Power (HM&IFP)/5th

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Module I (Hydraulic Turbines)

Q1 Define hydraulic machines. [2 M]

Q2 How do you classify the hydraulic turbines? [2 M]

Q3 Draw the layout of a hydroelectric power station and label it. [2 M]

Q4 Define specific speed of a turbine. [2 M]

Q5 Classify the turbines in terms of specific speed. [2 M]

Q6 Describe various efficiencies of a turbine. [2 M]

Q7 Give the comparison between impulse turbine and reaction turbine. [2 M]

Q8 Mention the importance of surge tank and draft tube used in a hydroelectric power plant. [2 M]

Q9 Give any three comparisons between Francis turbine and Kaplan turbine. [2 M]

Q10 Sketch a suitable diagram and explain the main parts of Kaplan turbine. [5M]

Q11 Write the advantages and disadvantages of Francis turbine over a Pelton Turbine. [5 M]

Q12 Explain the working of a Francis turbine with a neat sketch. [5 M]

Q13 In a Pelton turbine the diameter of the wheel is 2 m and the angle of deflection is 1620. The jet diameter is 165 mm and pressure behind the nozzle is 1000 kN/m2 and wheel rotates at 320 rpm. Find the hydraulic power developed and hydraulic efficiency. [10 M]

Q14 A Pelton turbine develops 8 MW under a head of 130 m at a speed of 200 rpm. If the values of coefficient of velocity is 0.98, speed ratio 0.46, jet diameter is 1/9th of the diameter of the wheel, and the overall efficiency is 87 %. Determine the flow required, diameter of the wheel, diameter of the jet, number of jets and number of buckets. [10 M]

Q15 A Francis turbine is to be designed to develop 360 kW under a head of 70 m and a speed of 750 rpm. The ratio of width of runner to diameter of runner is 0.1. The inner diameter of the runner is half the outer diameter. The flow ratio is 0.15. The hydraulic efficiency is 95 % and the mechanical efficiency is 84 %. Four percent of the circumferential area of runner is to be occupied by the thickness of the vanes. Determine diameter of the wheel, quantity of the water supplied, and guide vane angle at inlet. [10 M]

Q16 A Kaplan turbine develops 9100 kW of shaft power, with a net available head of 5.6 m, speed ratio of 2.09, flow ratio of 0.68; overall efficiency of 86 % and diameter of boss is 1/3rd diameter of runner. Find the diameter of runner and its speed. [10 M]

Module II (Centrifugal Pumps)

Q17 Explain the construction and working of centrifugal pump with a neat sketch. [2 M]

Q18 What is positive displacement pump? Why are they called so? [2 M]

Q19 Define slip, percentage slip and negative slip of a reciprocating pump. [5 M]

Q20 What is negative slip? When it happens in reciprocating pumps? [5 M]

Q21 What is cavitation? Write its effect in hydraulic pumps. [5 M]

Q22 A centrifugal pump delivers salt water against a head of 15 m at a speed of 100 rpm. The vanes are curved backward at 30º with the periphery. Obtain the discharge for an impeller diameter of 30 cm and outlet width of 5 cm at a manometric efficiency of 90%. [10 M]

Q23 The impeller of a centrifugal pump having external and internal diameters 500 mm and 250 mm respectively, width at outlet 50 mm and running at 1200rpm. Works against a head of 48 m. The velocity of flow through the impeller is constant and equal to 3 m/s. The vanes are set back at an angle of 40º at outlet. Determine: a) Inlet Vane angle, and b) Work done by the impeller and Manometric efficiency. [10 M].

Q24 The impeller of a centrifugal pump has an external diameter of 450 mm and internal diameter of 200 mm. The speed of the pump is 1440 rpm. Assuming a constant radial flow through the impeller at 2.5 m/s and that the vanes at exit are set back at an angle of 25º, determine: a) The inlet vane angle, b) The angle, the absolute velocity of water at exit makes with the tangent and, c) the work done per unit weight. [10 M]

Module III (Reciprocating Pumps)

Q25 What do you mean by slip in pump? [2 M]

Q26 Write any four differences between reciprocating pump and centrifugal pump. [5 M]

Q27 Derive the expression for discharge and power required for: [5 M]
single acting reciprocating pump, and b) double acting reciprocating pump

Q28 Explain the working principle of a single acting reciprocating pump with a neat sketch. [5 M]

Q29 Explain the working principle of a double acting reciprocating pump with a neat sketch. [5 M]

Q30 What are the advantages of double acting cylinder over a single acting cylinder? [5 M]

Q31 A double acting reciprocating pump, running at 65 rpm, is discharged at 2.5 m^3/min of water. The pump has a stroke of 650 mm. The diameter of the piston is 35 cm. The delivery and suction head are 2800 cm and 565 cm, respectively. Determine the slip, percentage slip, and power required to drive the pump. [10 M]

Q32 A single acting reciprocating pump having a cylinder diameter of 150 mm and stroke of 300 mm is used to raise the water through a height of 20 m. Its crank rotates at 60 rpm. Find the theoretical power required to run the pump and the theoretical discharge. If actual discharge is 5 lit/s find the percentage of slip. [10 M]

Q33 A single-acting reciprocating pump discharge 0.018 m3/s of water per second when running at 60 rpm. Stroke length is 500 mm and the diameter of the piston is 220 mm. If the total lift is 15 m, determine: a) Theoretical discharge of the pump, b) Slip and percentage slip of the pump, c) Co-efficient of discharge, and d) Theoretical Power required for running the pump. [10 M]

Q34 It is desired to have a discharge of water of 10 l/min using a reciprocating pump running at 42 rpm. The bore to stroke ratio is to be 1:1.5. It is expected that the slip will be 12%. Determine the bore and stroke for (a) single acting pump, and (b) double acting pump. If the total head is 30 m and the overall efficiency is 82%, determine the power required in both cases. [10 M]

Module IV (Pneumatic System)

Q35 Why air is preferred as the working medium in pneumatic pump? [2 M]

Q36 Discuss the function at reservoir in a pneumatic system. [2 M]

Q37 What do you mean by DCV (Directional Control Valve)? [2 M]

Q38 What is a flow control valve? State its functions. [2 M]

Q39 Write the advantages, disadvantages, and applications of pneumatic power. [5 M]

Q40 Draw the layout of pneumatic circuit indicating the basic components. [5 M]

Q41 Write the functions of Throttle valves, and Pressure control valves. [5 M]

Q42 Explain the working of 3/2 and 5/3 Directional Control Valve (DCV)? [5 M]

Q43 With a neat sketch explain the structure of a pneumatic control system. [10 M]

Module V (Hydraulic Control System)

Q44 What is an actuator? Classify the various types of actuators. [2 M]

Q45 What is the function of filter? [2 M]

Q46 What is the use of a check valve? [2 M]

Q47 List out basic elements of hydraulic circuit. [5 M]

Q48 Draw the symbols for a pressure relief valve and pressure reducing valve. [5 M]

Q49 State the functions of flow control valve and pressure control valve. [5 M]

Q50 Why are the hydraulic system is preferred for heavy work than pneumatic system? [5 M]

Q51 Explain the working of an external gear pump. [5 M]

Q52 Write a note on flow control valves. [5 M]

Q53 Explain with neat sketch about the Meter-in and Meter-out. [5 M]

Q54 Explain with neat sketch about spring loaded pressure relief valve and pressure reducing valve. [5 M]

Q55 Draw symbols of the Pressure relief valve and Double acting cylinder. [5 M]

Q56 Explain the working of: a) Internal gear pump and b) Vane pump [10 M]

Q57 Name any five basic components required in a hydraulic circuit and mention their functions. [10 M]

Q58 What are the advantages and limitations of a hydraulic system? Explain briefly. [10 M]

Q59 What is the function of pressure reducing valve? Explain its working with a neat diagram. [10 M]

Q60 Give the comparison between hydraulics and pneumatics drive systems. [10 M]

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