



UNIVERSITY OF MINES AND TECHNOLOGY, TARKWA

SECOND SEMESTER EXAMINATIONS, APRIL/MAY 2019

COURSE NO: GL 130

COURSE NAME: HYDRAULIC SYSTEMS

CLASS: GLI

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TIME: 2 HRS 30 MINS

Name: _____ Index Number: _____

ANSWER ALL QUESTIONS IN YOUR ANSWER BOOKLET

SECTION A

Choose the correct answer from the list of options given for each question. Indicate the correct answer in your answer booklet. The question paper must be tied loosely into the answer booklet and therefore not leaving the Examination Room.

- _____ states that when a confined fluid is placed under pressure, the pressure is transmitted equally in all directions and on all faces of the container.
 - Pascal's law
 - Bernoulli's Principle
 - Hydrostatics law
 - Hydraulic leverage
- Pressure in a fluid power system comes from:
 - Resistance to flow
 - Pump volume
 - Motor horsepower
 - Fluid velocity
- The inlet to a hydraulic pump is 0.6 m below the top surface of an oil reservoir. If the specific gravity of the oil used is 0.86, determine the static pressure at the pump inlet
 - 5.89 kPa
 - 5.06 kPa
 - 3.54 kPa
 - 3,700 Pa
- As flow increases, pressure _____
 - Increases
 - Decreases
 - Remains the same
 - None of the above
- The magnitude of the pressure drop will vary, depending upon:
 - Density of fluid
 - The rate of flow passing across the orifice
 - Volume of fluid
 - Bulk modulus of fluid
- A basic hydraulic system consists of all the following except
 - Pump
 - Reservoir
 - Accumulator
 - Actuator

7. Which of the following component of a hydraulic circuit is part of a basic hydraulic Jack
- a. Accumulator
 - b. Check ball
 - c. Pressure relief valve
 - d. Gear pump

Use **Figure 1** below to answer question **16** to **21**

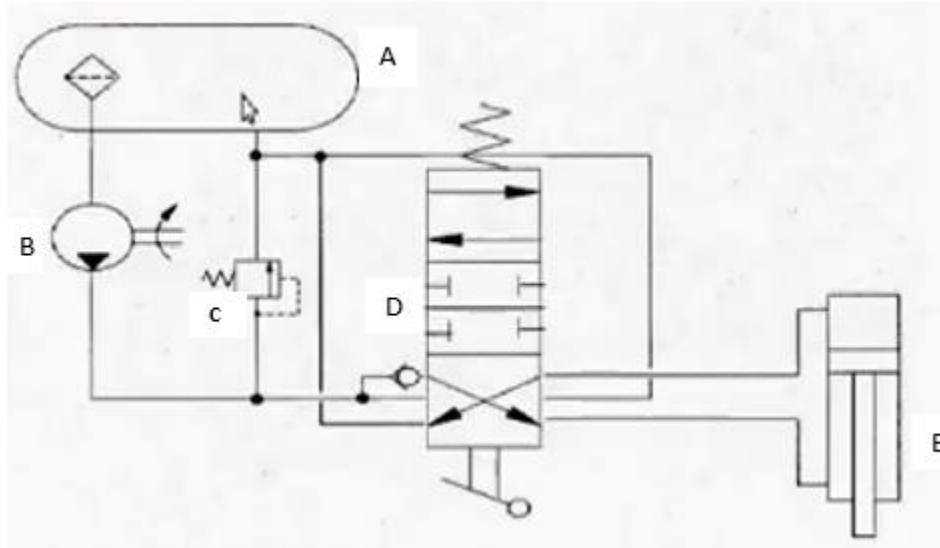


Figure 1

8. In which mode is the hydraulic system shown?
- a. Neutral position
 - b. Fluid moving to the top of the cylinder head
 - c. Fluid moving to the bottom side of the cylinder head
 - d. Off position
9. What does D represent in the circuit diagram?
- a. 4 port 3-position lever control spool valve
 - b. 2 ports 4- position pedal control spool valve
 - c. 4 port 3-position electric solenoid control spool valve
 - d. 2 port 3-position lever control spool valve
10. What does C represent in the circuit diagram?
- a. Closed pressure relief valve
 - b. Open pressure reducing valve
 - c. Open pressure relief valve
 - d. Closed pressure reducing valve
11. What does B represent in the circuit diagram?
- a. Variable reversible displacement pump
 - b. Simple fixed displacement pump
 - c. Reversible displacement pump
 - d. variable reversible displacement motor
12. The main function of a hydraulic fluids in a hydraulic system is _____
- a. Dissipation of heat
 - b. Transmission of power

- c. Lubrication of moving parts
- d. Sealing of clearances between mating parts
13. A hydraulic fluid which is too thin leads to:
- a. Power loss
- b. good seal at pumps
- c. good seals at valves
- d. Rapid wear of moving parts
14. _____ generate less heat when burnt.
- a. Fire resistance fluids
- b. Environmental Acceptable Hydraulic Fluids (EAHF)
- c. Mineral- Based Fluids
- d. None of the above
15. All the following are advantages of a non-positive displacement pumps except:
- a. Simplicity of operation and high reliability
- b. High volumetric efficiency
- c. Low initial cost and minimum maintenance
- d. capable of handling any type of fluid
16. _____ pumps discharge a fixed quantity of oil per revolution of the pump shaft
- a. Centrifugal
- b. Axial flow
- c. Radial flow
- d. Vane pump
17. In external gear pumps during suction the _____
- a. Teeth mesh
- b. Come out of the mesh
- c. the volume decreases
- d. Fluid is forced into the outlet
18. All the following are disadvantages of a lobe pump except?
- a. Well-suited for applications involving shear-sensitive fluids
- b. low-pressure rating
- c. show a greater amount of pulsation
- d. They are noisier than the other gear pumps
19. In _____ the reciprocating action of the pistons is obtained by bending the axis of the cylinder block so that it rotates at an angle different than that of the drive shaft.
- a. Bent-axis-type piston pumps
- b. Swash plate-type inline piston pumps
- c. Radial piston pump
- d. Vane pumps
20. The variation in actual pump capacity depends on all the following except
- a. Running clearance
- b. Discharge pressure

- c. Oil flash point
- d. Oil viscosity

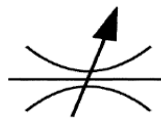
21. Which of these is the second sequence of things in the selection of pumps?

- a. Determining the flow-rate requirements
- b. Selection of the appropriate actuator based on the load encountered
- c. Selection of the pump-type based on the application
- d. Selection of system pressure requirements

22. The difference between closed and open center selector valve is with the _____

- a. Actuating cylinder
- b. OFF position
- c. First ON position
- d. Second ON position

23. What does the symbol below represent in a hydraulic system?



- a. Relief valve
- b. Unloading valve
- c. Adjustable flow control valve
- d. Servo valve

24. _____ prevents the hydraulic pressure from exceeding the allowable value in order to protect the circuit components from damage.

- a. Temperature switch
- b. Pressure switch
- c. Hydraulic fuse
- d. Servo valves

25. Filters installed in the in the pressure and return lines of a hydraulic system is known as_____

- a. Pressure filter
- b. Line filters
- c. Off-line kidney loop
- d. Breather

26. _____ is a device, which store energy in the form of fluid under pressure.

- a. Motor
- b. Pump
- c. Accumulator
- d. Cylinder

27. Which of the following indicates excessive heating in a hydraulic system?

- a. Excessive drive speed and loose intake lines
- b. An unusually warmer return line
- c. High fluid viscosity
- d. Low reservoir levels and contaminated filters

28. Which of the following is not a guideline to ensure safety in hydraulic systems?

- a. Put up safety notices to prohibit operation by other people
- b. The implications arising out of any action have to be considered before resorting to it
- c. The whole system should be pressurized before disconnecting any of the lines
- d. Ensure that the accumulators the hydraulic system are fully blown down

29. All the following are important functions of fittings except?

- a. Closing lines
- b. Connecting lines
- c. Providing branch connections
- d. Increasing flow

30. Which one of the following is not a preventive maintenance in a hydraulic system?

- a. Regular servicing of the equipment
- b. Checking for correct operation
- c. Identification of potential faults and their immediate correction
- d. Overhaul of the system

SECTION B

ANSWER TRUE OR FALSE in your answer booklet. Half mark will be deducted for every wrong answer given.

- 31. Hydrostatics is the study of liquids in motion and pressure in pipes and cylinders.
- 32. A spool valve is a type of flow control valve which consists of a large disk which is rotated inside a pipe.
- 33. Velocity of a fluid is the movement of a quantity of fluid during a period of time.
- 34. The function of a reservoir in a hydraulic system is to convert mechanical power to fluid power.
- 35. The volume of the fluid displaced by the piston during the discharge stroke is called the displacement volume of the pump.
- 36. Selector valves are also referred to as directional control valves.
- 37. In the closed-center valve, the pressure and return ports are open to each other when the valve is OFF.
- 38. The most widely used type of pressure control valve is the pressure relief valve.
- 39. A servo valve is a type of flow control valve which consists of a large disk which is rotated inside a pipe.
- 40. A centrifugal pump is an example of a non-positive displacement pumps.

SECTION C
ANSWER ONLY ONE question in this section.

QUESTION ONE

- a) Indicate the various components of the schematic circuit of a hydraulic system shown in Figure 1 and state the function of each component. **(12 marks)**

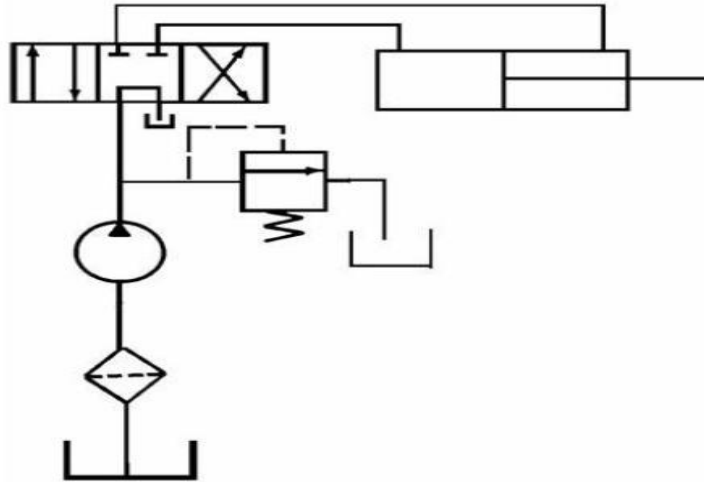


Figure 1

- b) With the aid of a labelled diagram, briefly explain how a simple hydraulic jack works. **(6 marks)**
- c) The inlet to a hydraulic pump is 0.5 m below the top surface of an oil reservoir. If the specific gravity of the oil used is 0.75, determine the static pressure at the pump inlet? **(2 marks)**

QUESTION TWO

- a) A gear pump has an outside diameter of 80 mm, inside diameter of 55 mm and a width of 25mm. If the actual pump flow is 1600 LPM and the rated pressure is 95 LPM Determine
- i. The volumetric displacement **(3 marks)**
 - ii. Theoretical discharge. **(3 marks)**
 - iii. Volumetric efficiency of the pump. **(3 marks)**
- b) A gear pump has a 75 mm outside diameter, a 50 mm inside diameter, and a 25mm width. If the volumetric efficiency is 80 % at rated pressure, the pump speed is 1000 rpm. Determine:
- i. The corresponding actual flow rate? **(3 marks)**
 - ii. The overall efficiency of the system if the mechanical efficiency of the pump is 92%. **(3 marks)**
- c) Briefly describe the pumping action. **(5 marks)**