UNIVERSITY OF MINES AND TECHNOLOGY, TARKWA

SECOND SEMESTER EXAMINATIONS, MAY 2018

COURSE NO: GL 130

COURSE NAME: **HYDRAULIC SYSTEM**

CLASS: GL1 **TIME**: 2 HOURS 30

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.

1. _____ is the study of liquids in motion and pressure in pipes and cylinders.
   a. Hydrodynamics
   b. Hydrostatics
   c. Hydraulics
   d. Hydraulic leverage
2. _____ describes the science of liquids under pressure.
   a. Hydrostatics
   b. Hydraulic leverage
   c. Hydraulics
   d. Hydrodynamics
3. _____ 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.
   a. Pascal's law
   b. Bernoulli's Principle
   c. Hydrostatics law
   d. Hydraulic leverage
4. The transmission of power from an essentially stationary, rotary source to a remotely positioned rotary or linear force amplifying device called an actuator is known as
   a. Hydraulics
   b. Hydraulic Power
   c. Hydraulic leverage
   d. Pressure
5. Pressure in a fluid power system comes from:
   a. Resistance to flow
   b. Pump volume
   c. Motor horsepower
   d. Fluid velocity

6. 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

   a. 5.89 kPa
   b. 5.06 kPa
   c. 3.54 kPa
   d. 3,700 Pa

7. As flow increases, pressure _____

   a. Increases
   b. Decreases
   c. Remains the same
   d. None of the above

8. The movement of a quantity of fluid during a period of time is_____

   a. Velocity
   b. Flow
   c. Pressure
   d. Fluid power

9. In _____all particles of the fluid would be moving parallel to each other.

   a. Turbulent flow
   b. Dynamic Flow
   c. Laminar flow
   d. Haphazard flow

10. The magnitude of the pressure drop will vary, depending upon:

    a. Density of fluid
    b. The rate of flow passing across the orifice
    c. Volume of fluid
    d. Bulk modulus of fluid

11. Bernoulli's Principle tells us that the sums of pressure and kinetic energy at various points in a system must be constant if, _____ is constant

    a. Flow
    b. Velocity
    c. Pressure
    d. Area

12. A basic hydraulic system consists of all the following except

    a. Pump
    b. Reservoir
    c. Accumulator
    d. Actuator

13. 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

14. The large piston in a hydraulic lift has an area of 250 cm^2. What force must be applied to the small piston with an area of 25 cm^2 in order to raise a car of mass 1500 kg?

    a. 150 N
    b. 1,472 N
    c. 2,561 N
    d. 147, 150 N

15. The function of a reservoir in a hydraulic system is to:

a. Convert the fluid energy into mechanical force

b. Control the flow

c. Convert mechanical power to fluid Power

d. Hold the fluid

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

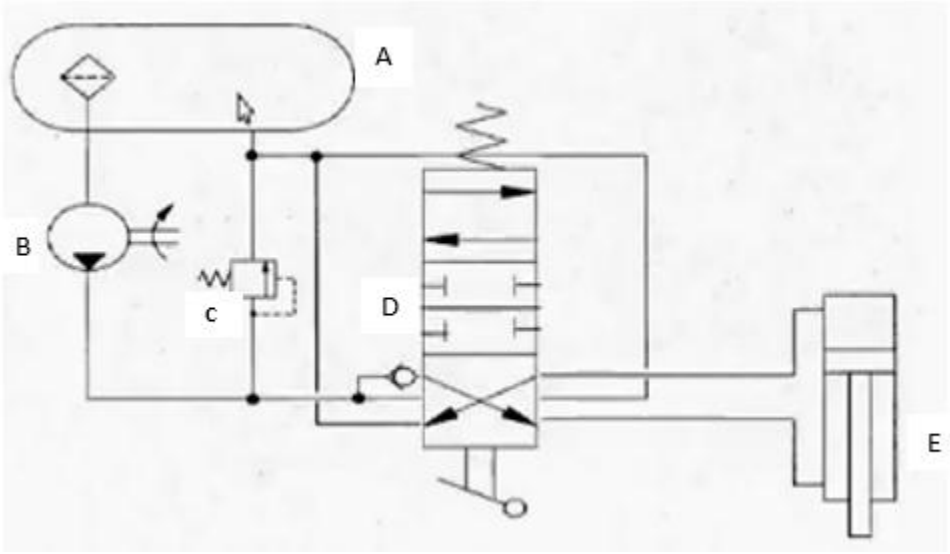

Figure 1

16. 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

17. 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

18. 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

19. What does E represent in the circuit diagram?

a. Single Action actuating cylinder
b. Two side action actuating cylinders
c. Double action actuating cylinder
d. One side action actuating cylinder

20. What does A represent in the circuit diagram?

a. Non-pressurized reservoir
b. Vented reservoir
c. Pressurized reservoir
d. None of the above

21. 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

22. Viscosity is a measure of the hydraulic fluids:

a. Temperature
b. Colour
c. Thickness
d. Smell

23. 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

24. A good hydraulic fluid must have all the following properties except?

a. Large bulk modulus
b. Ideal viscosity
c. Low volatility
d. High density

25. 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

26. _____ is the temperature at which a liquid gives off vapor in sufficient quantity to ignite momentarily when a flame is applied.

a. Pour point
b. Fire point
c. Flash point
d. Ignition point

27. Which of the following properties is desirable in a hydraulic fluid?

a. Low fire point
b. High bulk modulus
c. High viscosity
d. Low flash point

28. _____ generate less heat when burnt.

a. Fire resistance fluids
b. Environmental Acceptable Hydraulic Fluids (EAHF)
c. Mineral- Based Fluids
d. None of the above

29. Hydraulic Fluids should be stored in a:

a. A damp moist atmosphere
b. an open container
c. A closed and sealed container
d. Open container inside a room

Use the **Figure 2** to answer **30** & **31**

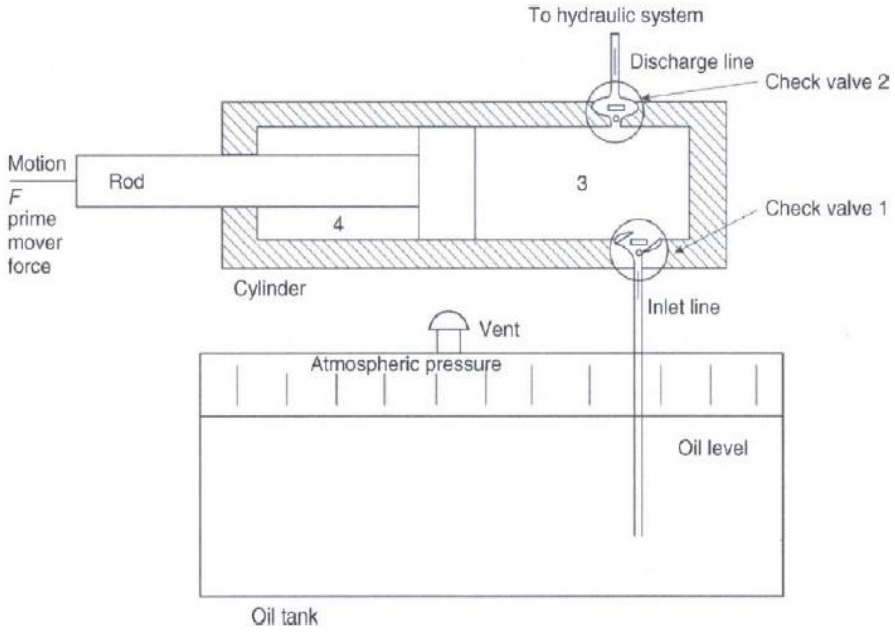

Figure 2

30. When the piston is pushed to the left:

a. A partial vacuum is created in the pump cavity 4
b. Check valve 2 opens and check valve 1 closes
c. Check valve 1 opens and check valve 2 closes
d. Atmospheric pressure force oil to move from pump cavity 3 into the oil tank

31. When the fluid is pushed to the right:

a. The fluid movement closes check valve 1 and opens check valve 2
b. Partial vacuum holds the check valve 2 against its seat
c. a partial vacuum is created in the pump cavity 3.
d. A partial vacuum is created in the pump cavity 4

32. Which of the following is an example of a non-positive displacement pump?

a. Vane pump
c. Centrifugal pump
b. Gear pump
d. Screw pump

33. All the following are advantages of a non-positive displacement pumps except:

a. Simplicity of operation and high reliability
c. Low initial cost and minimum maintenance
b. High volumetric efficiency
d. capable of handling any type of fluid

34. _____ pumps discharge a fixed quantity of oil per revolution of the pump shaft

a. Centrifugal
c. Radial flow
b. Axial flow
d. Vane pump

35. In external gear pumps during suction the _____

a. Teeth mesh
c. the volume decreases
b. Come out of the mesh
d. Fluid is forced into the outlet

36. A gear pump has a 75 mm outside diameter, a 50 mm inside diameter, and a 25 mm width. If the volumetric efficiency is 90% at rated pressure, what is the corresponding actual flow rate? The pump speed is 1000 rpm.

a. 0.05 m^3/min
c. 0.04 m^3/min
b. 0.06 m^3/min
d. 0.03 m^3/min

37. All the following are disadvantages of a lobe pump except?

a. Well-suited for applications involving shear-sensitive fluids
c. show a greater amount of pulsation
b. low-pressure rating
d. They are noisier than the other gear pumps

38. 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
c. Radial piston pump
b. Swash plate-type inline piston pumps
d. Vane pumps

39. The variation in actual pump capacity depends on all the following except

a. Running clearance
c. Oil flash point
b. Discharge pressure
d. Oil viscosity

40. 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

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

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

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

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

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

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

44. Filters installed in the in the pressure and return lines of a hydraulic system is known as____

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

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

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

46. 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

47. 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

48. More than _____ of the problems encountered in hydraulic systems have been observed to be related to hydraulic oil.

a. 70 %

b. 50 %

c. 90 %

d. 20 %

49. 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

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

a. Closing lines

b. Connecting lines

c. Providing branch connections

d. Increasing flow

SECTION B

ANSWER ONLY ONE question in this section.

QUESTION ONE

A gear pump has an outside diameter of 70 mm, inside diameter of 56 mm and a width of 20 mm. If the actual pump flow is 1800 RPM and the rated pressure is 95 LPM. Determine:

a) The volumetric displacement **(2 marks)**
b) Theoretical discharge. **(2 marks)**
c) Volumetric efficiency of the pump **(2 marks)**
d) If the theoretical torque required to operate the pump and the actual torque delivered to the pump are 80 N-m and 95 N-m respectively, determine the overall efficiency of the pump (**4 marks)**

QUESTION TWO

a) A cylinder contains a fluid at a gauge pressure of 360 kN/m^2. Express this pressure in terms of

   i. a head of water, **(3 marks)**

   ii. Mercury of specific gravity (S G) = 12.5, Density of water is 1000 kg/m^3, use acceleration due to gravity (g) of 9.8 m/s. **(3 marks)**

b) 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)**

c) A gear pump has a 75 mm outside diameter, a 50mm inside diameter, and a 25mm width. If the actual pump flow at 1800 rpm and rated actual flowrate of 0.106 m^3/min. What is the volumetric efficiency? **(2 marks)**

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