TECHNICAL UNIVERSITY OF MOMBASA

Faculty of ENGINEERING & TECHNOLOGY

DEPARTMENT OF MECHANICAL AND AUTOMOTIVE

UNIVERSITY EXAMINATIONS FOR DEGREE IN

BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING

EMG 2312: INDUSTRIAL HYDRAULICS

END OF SEMESTER EXAMINATIONS

YEAR 4 SEMESTER 2

SERIES: DECEMBER 2013

TIME: 2 HOURS

INSTRUCTIONS:

1. You are required to have the following for these examinations:
   - Answer Booklet
   - Scientific Calculator

2. This paper has **FIVE** questions
3. Answer any **THREE** questions.
4. All questions carry equal marks
5. This paper consists of **THREE** printed Pages.

QUESTION 1

(a) Define ‘’Hydraulics’’giving examples. (2marks)

(b) With an aid of a diagram ,state the following:

i) Pascal’s Law
(3marks)

ii) Interaction of hydraulic and atmospheric pressure
(3marks)

(c) Although friction (in industrial hydraulic systems) cannot be eliminated entirely, it can be controlled to a certain extent. State the THREE main causes of excessive friction in hydraulic systems. (3marks)

(d) Illustrate with the aid of a diagram and explain the effect of friction on pressure. (3marks)

QUESTION 2

(a) Calculate the specific weight, density and specific gravity of one liter of a liquid which weighs 7N. (6marks)

(b) Hydraulic oil ISO 68 is flowing through a hydraulic line with inside diameter 0.05m at a rate of 200gpm. Find the pressure drop in psi for a 3m length of hose. Given Hydraulic oil ISO 68 has a density of 880kg/cu-m and a kinematic viscosity of $6.8 \text{ x} 10^{-5} m^{2/5}$ at 104^0F and $Q = 0.0126cu - \frac{m}{s}$.
(8marks)

(c) $10m^3/h$ of water flows through a pipe 100mm inside diameter. The pipe is later reduced to an inside diameter of 80mm. Calculate the flow velocity in each section of the pipe. (4marks)

(d) A new sewer line calls out a 0.6% slope of the line . An elevation reading of 108.8 feet at the manhole discharge and an elevation of 106.2 feet at a distance of 200 feet from the manhole are recorded. What is the existing slope of the line that has been installed? (2marks)

QUESTION 3

a) i) Outline THREE functions of a hydraulic system reservoir.

ii) Explain the principle of operation of the following hydraulic filters:
- Surface filtration
- Depth filtration (5marks)

b) A hydraulic system is to be designed for clamping work and to perform drilling operation. The system is to consist of the following components:

i) Reservoir
ii) Pump
iii) Relief valve
iv) Manually operated spring centered three position four way directional control value.
v) TWO sequence valves
vi) TWO double acting actuators.

Using two line diagram and hydraulic symbols design draw a suitable circuit diagram for the system.

c) Outline TWO possible causes and the remedies for each of the following trouble in hydraulic system:
i) Absence of proper speed and torque of the hydraulic motor.
ii) Sudden drop of pressure in the accumulator. (5marks)

QUESTION 4

a) (i) State FOUR major functions of a hydraulic accumulator. (2marks)

(ii) Assisted by diagrams, differentiate between a spring-loaded accumulator and a Bag-Type Accumulator. For any one of these accumulator, describe its operations and the limitations. (4marks)

b) (i) Differentiate between filters and strainers and name the THREE parts of a Full-flow hydraulic filter and their functions. (4marks)

(ii) Describe the structure and operation of a proportional flow filter and state when it could be Used. (3marks)

c) (i) In addition to flexible hoses mention TWO other types of hydraulic fluid conductors and give THREE reasons why loses are the best form of the fluid power plumbing. (3marks)

(ii) List down FOUR requirements of the fluid power plumbing. (4marks)

QUESTION 5

a) (i) State FOUR ways in which fluid contaminant can get into an hydraulic system. (2marks)

(ii) State why water as a contaminant in mineral based oils is undesirable and mention THREE Methods used to remove water from an hydraulic fluid. (3marks)

b) (i) Give THREE reasons why it is impossible to use hydraulic motors as hydraulic pumps.(2marks)

(ii) Mention and explain THREE types of hydraulic motor efficiencies. (2marks)

c) A hydraulic motor has a displacement of 130cm^3/rev and operates with a pressure of 105 bar and a speed of 2000rpm. If the actual flow rate consumed by the motor is 0.005m^3/s and the actual torque delivered by the motor is 200N-m. Calculate:

i) The motor overall efficiency (3marks)

ii) The kw power delivered by the motor (2marks)

d) (i) List down THREE reasons why a pump might produce noise when in operation. (3marks)

(ii) Discuss THREE types of hydrostatic pump efficiencies. (2marks)