MVM – Hydraulic Pneumatic

T066

Thursday, 12/11/2015
08:30 – 11:30

WORKFORCE DEVELOPMENT AUTHORITY

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ADVANCED LEVEL NATIONAL EXAMINATIONS, 2015, TECHNICAL AND PROFESSIONAL TRADES

EXAM TITLE: **Hydraulic Pneumatic**

OPTION: **Motor Vehicle Mechanics (MVM)**

DURATION: **3hours**

INSTRUCTIONS:

The paper is composed of **three (3) Sections**:

Section **I**: Sixteen **(16)** questions, all **Compulsory**. **55marks**

Section **II**: Five (5) questions, **Choose Three (3) only**. **30marks**

Section **III**: Three (3) questions, **Choose only One (1)**. **15marks**

Every candidate is required to strictly obey the above instructions. Punishment measures will be applied to anyone who ignores these instructions.

Section I. Sixteen (16) Compulsory questions. **55marks**

01. A double acting cylinder is used to push and pull 10000 N and they have $10mm^2$ and $5mm^2$ area on the piston and rod side areas. Determine the pressure induced due to loads. **3marks**

02. What are six basic components of equipment required for generation of energy in a hydraulic system? **6marks**

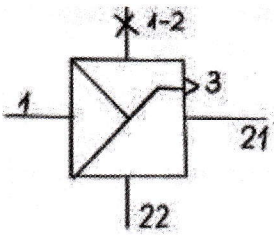
03. Name two broad classifications of hydraulic pumps? Give an example for each case. **4marks**

04. State three auxiliary methods of reducing the moisture content in air. **3marks**

05. Air at atmospheric pressure is compressed by an air compressor to $1/6^{th}$ the volume. What is the gauge pressure of the air assuming a constant temperature process? (Boyle's Law). **3marks**

06. 0.8 m^3 air at temperature T_1 = 303 K (30 °C) are heated to T_2 =345 K (72°C). How much does the air expand? **2marks**

07. The graphic symbol below represents a pressure regulator.



Explain the meaning of the digit numbers presented on the symbol? **5marks**

08. A hydraulic cylinder is to compress a car body in 10 seconds. The operation requires a stroke of 3m and a force of 40000N. If a 7.5 N/mm^2 pump has been selected, find the following:

a) Required piston area and piston diameter;

b) The necessary pump flow;

c) The hydraulic power capacity in kW. **5marks**

09. Define the pressure dew point. **2marks**

10. Name three factors that affect dew point. **3marks**

11. State three purposes of brakes in a vehicle. **3marks**

12. Name the unity which releases air from compressor of a brake system. **1mark**

13. Apart from storing the oil, what are the functions of the reservoir of a hydraulic circuit? **3marks**

14. An air motor produces a rotary motion, which can be transmitted through a rotating shaft.

(a) What are the advantages of this actuator?

(b) Give one example of the use of air motor **4marks**

15. Define the term "fluid power" in industry. **1mark**

16. Determine the force that can be applied by a hydraulic booster with the following details:

- Air piston area = 12500 mm^2;
- Oil piston area = 625 mm^2;
- Load piston area = 15600 mm^2;
- Air pressure = 0.75 N/mm^2 **3marks**

Section II. Answer any three (3) questions of your choice

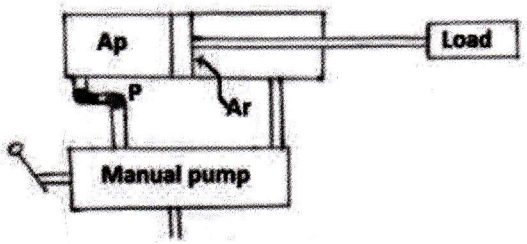
(Do not choose more than <u>three questions</u>). 30marks

17. With the help of neat sketches, state and explain the difference between single acting cylinder and double acting cylinder actuators. **10marks**

18. With the help of neat sketches describe and differentiate a check valve from a shuttle valve. **10marks**

19. Distinguish between positive displacement and dynamic (non-positive displacement) pumps. **10marks**

20. Consider the hydraulic piston shown in figure below, used to push a load of 1000N. The piston is actuated by a manual pump that compresses a fluid to the piston through a pipe with inside diameter of 10mm. The diameter of the cylinder is 100mm and the diameter of the rod is 40mm.



Determine the human force needed to act on the piston:

(a) in extension stroke;

(b) in retraction stroke. **10marks**

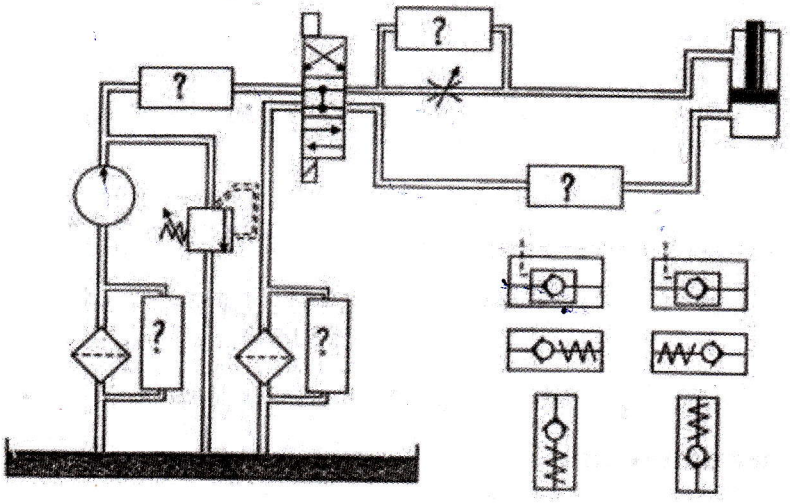
21. Describe the working principle of the air compressor used in air brake system. **10marks**

Section III. Answer any one (1) question of your choice

(Do not choose more than <u>one question</u>). 15marks

22. **a)** Name six different devices generally used to control precisely the level of pressure. (Pressure control valves).

b) Copy the diagram below (incomplete) and locate correctly the different check valves.



c) Draw the hydraulic symbol for the following flow control valves: Throttling; Fixed or Non-adjustable; Adjustable and Pressure compensated. **15marks**

23. Name the possible causes of troubles below in hydraulic system:

a) Pump making noise.

b) Pump oil over-hearted. **15marks**

24. List the possible causes of troubles below in pneumatic systems:

a) Regulator cannot reach high set point;

b) Excessive pressure drop through filter of FRL unit;

c) Too much oil delivery by the lubricator. **15marks**