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Question Paper Code : 51342

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2024.

Fourth/Fifth/Sixth Semester

Mechanical Engineering

ME 3492 – HYDRAULICS AND PNEUMATICS

(Common to : Automobile Engineering/Mechanical Engineering (Sandwich)

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Identify a basic law that governs fluid power system and state its significance?

2. Compare hydraulic and pneumatic drives of automation with respect to accuracy, maintenance cost and speed control.

3. Write the differences between pressure relief valve and pressure reducing valve.

4. List the functions of an accumulator in hydraulic applications.

5. State the significance of servo and proportional valve.

6. Select an application for fail-safe circuit with reasoning.

7. Differentiate on-delay and off-delay timers.

8. List the important factors for a pneumatic circuit design.

9. Why pressure drop is observed in pneumatic cylinders?

10. Mention the advantages of IoT in hydraulics systems.

PART B — (5 × 13 = 65 marks)

11. (a) The system shown in Figure 11 (a) contains a hydraulic pump delivering high pressure oil of specific gravity 0.9 and kinematic viscosity $1.25\times10^{-4}\ m^2/s$, to a hydraulic motor. A 25 m pipe of internal diameter 30 mm and thickness of 10 mm connects the pump and motor. The pipe has two elbow fittings (k = 0.70) and one check valve (k = 4.0). The motor is placed 10 m above the pump. The pressure required to drive the loaded motor is 40 bar. Determine the pump discharge pressure, if the discharge from the pump is 180 lpm

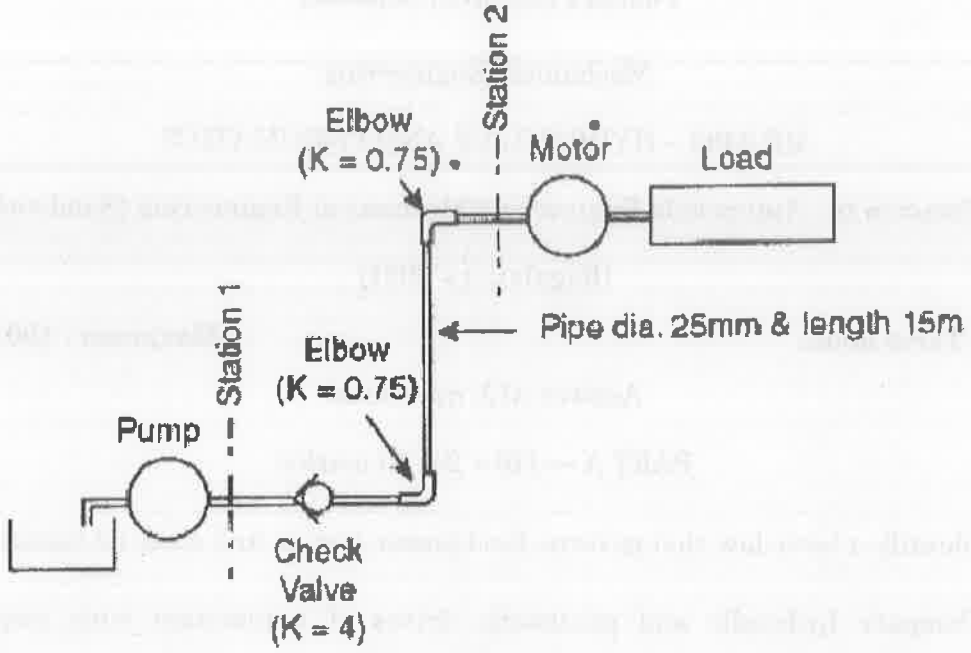

Fig 11 (a)

Or

(b) (i) Explain any six desirable properties of hydraulic oil used for industrial automation.

(ii) Mention the criteria for selection of such fluids for hydraulic applications. (7+8)

12. (a) Explain the working principle of 4/2 solenoid operated direction control valve for hydraulic applications.

Or

(b) With neat circuits, explain the application of any four pressure control valves.

13. (a) With neat circuits explain the four applications of an accumulator in hydraulic circuits.

Or

(b) What is the condition for the speeds of extension and retraction strokes to be equal? Design hydraulic circuit accordingly.

14. (a) Design a pneumatic sequencing circuit for the sequence A+ A– B+ B– C+ C– using cascade method.

Or

(b) Elaborate on the working of regulator and lubricator in a pneumatic FRL unit.

15. (a) Sketch and explain the elements in a hydraulics power pack.

Or

(b) An industry is interested in developing a hydraulic drilling machine to drill 10 mm thick steel plates. Since, the cycle time of the process has to be minimum, faster approach and retraction strokes are essential. A powerpack with a single pump system is already available with the industry and hence the same is proposed to be used. As an automation engineer, develop an appropriate circuit to achieve the above objectives. Justify that the extension velocity is faster than in the conventional hydraulic circuit and derive the expression for velocity ratio.

PART C — ($1 \times 15 = 15$ marks)

16. (a) A pressure sequence clamp-drill circuit is to be designed to exert a clamping force on the work piece, followed by the advance of the drill. The drill portion of the cycle should have a rapid approach, followed by a slow advance. The circuit should unload when the control valve is in the center position. On the return portion of the cycle, the drill should retract first, followed by opening of the clamp. Two double-acting cylinders are to be used. Neatly sketch this hydraulic circuit.

Or

(b) Badges are to be produced from a very thin metal sheet. A press with a stamping die is available for this purpose. The double acting cylinder should extend when both the push buttons 'S1' and 'S2' are pressed simultaneously. The return stroke is to occur automatically only after the forward end position and preset pressure have been reached to get the consistent quality. The cylinder should immediately retract if Emergency push button 'S3' is pressed. Draw an electro-pneumatic ladder diagram for the above application.