B.E DEGREE EXAMINATIONS: APRIL 2015

(Regulation 2009)

Sixth Semester

MECHANICAL ENGINEERING
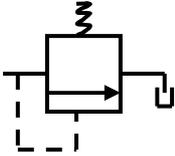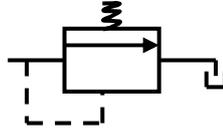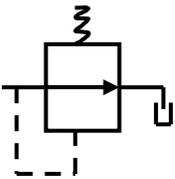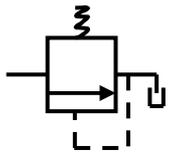
MEC116: Fluid Power Systems

Time: Three Hours   **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Which of the following statements are true?

   (i) Higher value of bulk modulus of hydraulic oil indicates that the oil is more compressible

   (ii) The life of oil at 50^0C may get reduced by 30% to 50% of oil life at 38^0C

   (iii) Phosphate esters can be used as a hydraulic fluid.

   a) (i) & (ii)   b) (ii) & (iii)

   c) (i) & (iii)   d) (i), (ii) & (iii)

2. Which of the following cylinder is characterized by two pistons operating in series within a common bore?

   a) Double rod cylinders   b) Tandem cylinders

   c) Telescopic cylinders   d) Rodless cylinders

3. Which of the following number represents the working port of a valve, as per ISO 5599-3?

   a) 1   b) 2

   c) 3   d) 12

4. Pick out the correct symbol for pressure relief valve

   a)   b)

   c)   d)

5. Which of the following are static seals?

   (i) O-rings   (ii) Gaskets   (iii) U rings   (iv) metal piston rings

a) (i) & (ii)   b) (iii) & (iv)

c) (i), (ii) & (iii)   d) (i), (ii), (iii) & (iv)

6. Which of the following is used to multiply forces when a great force is required for relatively short distance?

a) Flow control valve   b) Intensifier

c) Deceleration valve   d) Shuttle valve

7. Which of the following symbol corresponds to a Quick exhaust valve?

a)   b)

c)   d)

8. The generally recommended operating pressure in for a typical pneumatic system is

a) 10 bar   b) 50 bar

c) 100 bar   d) 300 bar

9. Which of the following device is used as a feedback device in servo valves?

a) LVDT   b) Strain gauge

c) Accelerometer   d) Loadcell

10. . Which of the following statements are true?

(i) Ladder logic diagram is the most preferred PLC programming method

(ii) The output signal of a thermocouple can be an input to PLC

(iii) Timers and counters are available in software form in a PLC

a) (i) & (ii)   b) (ii) & (iii)

c) (i) & (iii)   d) (i), (ii) & (iii)

PART B (10 x 2 = 20 Marks)

11. Sketch the ISO symbol for the following valves:

(i) One way flow control valve   (ii) unidirectional variable pneumatic motor

12. Cushioning is essential for longer life of cylinders – justify.

13. In a shuttle valve, air at 3 bar pressure is supplied to input port-1 and air at 6 bar pressure is supplied to input port-2. Which input port will supply air to the output port of the shuttle valve? Justify your answer.

14. Develop a ladder logic diagram for the logic $A1 = (b0.c1) + (d1+e0)$, where A1 corresponds to a solenoid operated valve and b,c,d,e are limit switches.

15. List any two materials used for seals and mention their advantages.

16. Why connecting cylinders in parallel are not preferred for synchronizing circuits?

17. 'It is not advisable to inhale the air exhausted from industrial pneumatic systems'-why?

18. Mention any four advantages of pneumo-hydraulic circuits

19. Distinguish between servo and proportional valves.

20. With an application, state the significance of fluidic devices in fluid power systems.

PART C (5 x 14 = 70 Marks)

21. a) (i) Compare hydraulic and pneumatic sources of automation. (7)

    (ii) With a neat sketch, explain the working of an external gear motor (7)

    (OR)

    b) (i) Explain the effect of Viscosity and Oxidation stability of hydraulic oil on system performance. (7)

    (ii) With a neat sketch, explain the working of a vane pump. (7)

22. a) (i) With a neat sketch, explain the working of a 3/2 pilot operated spring return valve. (7)

    (ii) Citing an industrial example, explain the significance of a counterbalance valve. (7)

    (OR)

    b) (i) Illustrate the working of a rotary spool directional control valve with an example. (7)

    (ii) Explain the working of a pressure sequencing valve with a neat sketch. (7)

23. a) (i) A hydraulic cylinder with a bore diameter of 50 mm has to operate at a maximum pressure of 200 bar. The tensile strength of the cylinder material is 730 MPa. Determine the tube thickness of the hydraulic cylinder , assuming a factor of safety of 4:1. (7)

    (ii) 'A drilling machine requires rapid spindle advance (extension), slow feed during drilling (extension) and retraction of spindle'. With a neat sketch, explain the hydraulic circuit appropriate for the above application. (7)

    (OR)

    b) A pump/ accumulator power pack is to supply the fluid flow demanded by a hydraulic system as shown in Fig.1. The system working pressure is 130 bar and the maximum pressure at the accumulator is 215 bar. Assuming the accumulator pre-charge pressure is 90% of its maximum working pressure, determine (i) the actual pump delivery required (ii) the maximum volume of fluid to be stored in the accumulator (iii) the accumulator volume assuming an isothermal charge and discharge of the accumulator.
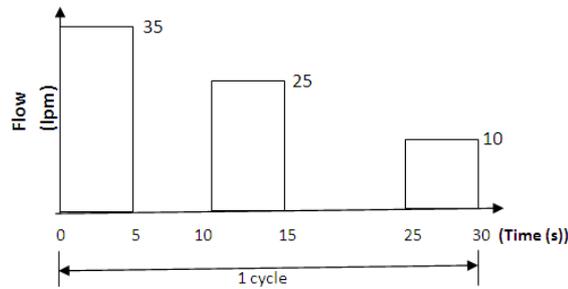
Fig.1 Hydraulic system demand

24. a) List the pneumatic components and explain the working principle of a quick exhaust valve with the aid of a sketch.

(OR)

b) Outline the importance of fluid power circuit design and Illustrate fail-safe circuit with an example

25. a) (i) With a neat sketch, explain the use of hydro-mechanical servo valve in an   (7) automotive power steering

(ii) Elaborate on the operation cycles of a PLC   (7)

(OR)

b) Valve bodies are to be marked with the letters 'KCT', as shown in Fig.2. The valve bodies are placed in the holder manually. Stamping cylinder (A) stamps the letters in the body. Ejector cylinder (B) pushes the parts from the holder in to a basket. The positions of the cylinders are confirmed using limit switches. Develop a pneumatic circuit for the above application using Cascade method. The cycle has to start only if a start button is pressed by the operator.
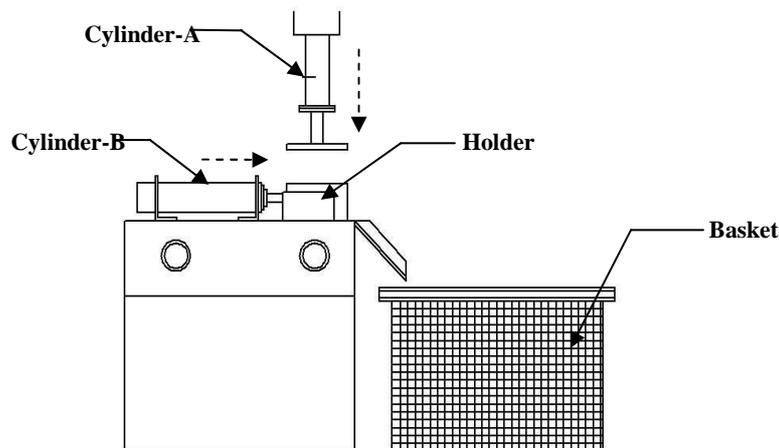

Fig.2 Stamping station

****