

M.E mech (machine design) sem IV

V-Ex-107-F-22

Design of Power Transmission System

PTDC

14/6/07

master

Con. 3347-07.

(REVISED COURSE)

System

BB-1690

(4 Hours)

[Total Marks : 100

- N.B. :**
- (1) Question No. 1 is compulsory.
 - (2) Attempt any four questions from the remaining six questions.
 - (3) Assume suitable data wherever required, giving reasons.
 - (4) Draw sketches to illustrate your answers.
 - (5) Use of standard databooks such as PSG Design Databook is permitted.
 - (6) Figures to the right indicate full marks.

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1. Answer any four of the following :—

- (a) Explain briefly various hydraulic direction control valves.
- (b) Advantages and disadvantages of pneumatic power and control systems.
- (c) Write short note on FRL unit.
- (d) Draw hydraulic circuits showing pressure relief valve, pressure reducing valve, sequence valve, pressure unloading valve and back pressure valve indicating their functions.
- (e) Explain the use of flexible power transmission elements. State merits and demerits.

2. (a) Design a chain drive to transmit 5.5 kW power from an electric motor rotating at 725 RPM to an air blower operating at 250 RPM. The drive operates continuously 24 hrs/day. Draw dimensioned sketches. 10
- (b) For the above application if v-belt drive is used, selecting suitable belt section and pulley materials, design and sketch the drive. 10

3. Following data relates to the trolley travel mechanism of an EOT crane :—

Weight of trolley including load to be lifted	= 140 kN
Traction effort	= 28 N/kN
Trolley wheel diameter	= 320 mm
Trolley travel speed	= 30 m/min
Application	= Class II

- (a) Select suitable trolley travel motor including type, power, speed and other specifications. Suggest suitable power transmission system giving brief description of the elements like type, number of stages, reduction ratio etc. Draw a neat schematic diagram of the drive with preliminary details of the drive elements including brake and clutch if used. 10
- (b) Choosing suitable type, design and sketch the brake for the above mechanism. 10
4. (a) Design a pneumatic control system to operate two sliding doors simultaneously (open or shut) by two pneumatic cylinders either from inside or from outside using push buttons. By pressing the same or the other push button alternately the doors should open or close as the case may be. Draw the circuit diagram with specifications of components. Explain working. 10
- (b) Design a fully automatic pneumatic control system to operate two cylinders in sequence. The first piston should move forward followed by the second cylinder piston to move forward. When the second piston is fully forward, the first piston should retract, followed by the second piston. The next cycle should be initiated automatically by the last operation of the previous cycle. Draw the circuit diagram, labelling the components with specifications. Explain the working. 10
5. (a) A hydraulic cylinder has a bore 125 mm, rod diameter 70 mm. It drives a mass of 2 tonnes vertically up and down at a maximum speed of 2 m/s. The lift speed is set by adjusting the pump displacement and the retract speed by flow control valve. The load is slowed down to rest in the cushions length of 40 mm. If the relief valve is set at 140 bar, determine the average pressure in the cushion on extend and retract strokes. 10
- (b) A mass of 2 tonnes is to be accelerated vertically up and down upto a velocity of 2 m/s from rest over a distance of 80 mm. Friction in guides is 10 percent of load lifted. Calculate the bore of cylinder required if the maximum allowable pressure at full bore is 120 bar. The seal friction equals to pressure drop of 5 bar and back pressure 5 bar. Select suitable type and size pump and draw circuit diagram. 10

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6. A hydraulic cylinder has to operate with following cycle :-

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- (a) extend 135 mm at 30 bar in 6 sec.
- (b) extend 15 mm at 200 bar in 4 sec.
- (c) remain extended at 200 bar for 20 sec.
- (d) retract 150 mm at 30 bar in 5 sec.
- (e) remain retracted for 15 sec.

7. Cylinder diameter is 200 mm, piston rod diameter 120 mm and stroke 150 mm. Draw displacement, flow and pressure diagrams.

- (i) Design and analyse hydraulic system using two fixed discharge pumps.
- (ii) Design and analyse hydraulic system using a single fixed displacement pump and an accumulator.

8. (a) Design a Worm and Worm-gear drive for a belt conveyor driver from an electric motor of 30 kW at 1450 RPM. The reduction ratio is 25.

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(b) Explain with a neat sketch the working of any one hydraulic motor.

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