

**AGRICULTURAL AND FOOD ENGINEERING DEPARTMENT
IIT KHARAGPUR**

**Mid-Autumn Semester Examination 2015-2016
4th Year B. Tech. (Hons.) & Dual Degree Students**

Date of Exam: 17-09-2015 (AN)

Max. Marks: 40

Subject No.: AG40017

Time: 2 h

Subject Name: Advances in Tractor Hydraulics and Transmission

No. of Students: 17

Instructions: 1. Answer all the questions.

2. Make justified assumptions wherever necessary.

1. a) Classify the pumps by giving their flow-pressure characteristics? And also mention the subclasses in each category.
b) Explain the working principle of an internal gear pump with a neat sketch and also give expression for the displacement.
c) A pump has a displacement volume of 98.4 cm^3 . It delivers $0.0152 \text{ m}^3/\text{s}$ of oil at 1000 rpm against a system pressure of 70 bar. If the prime mover input torque is 124.3 N m,
(i) What is the overall efficiency of the pump?
(ii) What is the theoretical torque required to operate the pump? [3+4+1.5+1.5=10]
2. a) Derive expressions for volumetric, torque and overall efficiencies of both pump and hydraulic motor.
b) A vehicle weighing 2 tonnes is to be driven up a slope of 1 in 10 (1 vertical in 10 measured along the slope) at a speed of 20 km/h. The coefficient of rolling resistance may be taken as 0.1. The vehicle is driven hydraulically by two fixed-displacement motors fitted in the rear wheels which have an effective diameter of 850 mm. The volumetric and torque efficiency of the motors are both 0.95. The maximum pressure drop across the motors is 250 bar.
Determine: (i) The required motor displacement, and
(ii) The fluid flow from the pump at maximum speed. [4+3+3=10]
3. a) Draw the characteristic curves of constant power and constant torque transmission systems. Also explain the nature of both characteristic curves?
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 100 bar and the maximum pressure at the accumulator is 180 bar. Assuming the accumulator pre-charge pressure is 95% of its maximum working pressure.
Determine: (i) the actual pump delivery required,
(ii) The maximum volume of fluid to be stored in the accumulator, and

- (iii) The accumulator volume assuming isothermal charge and adiabatic discharge of the accumulator. (Take adiabatic index as 1.4). [3+2+2+3=10]

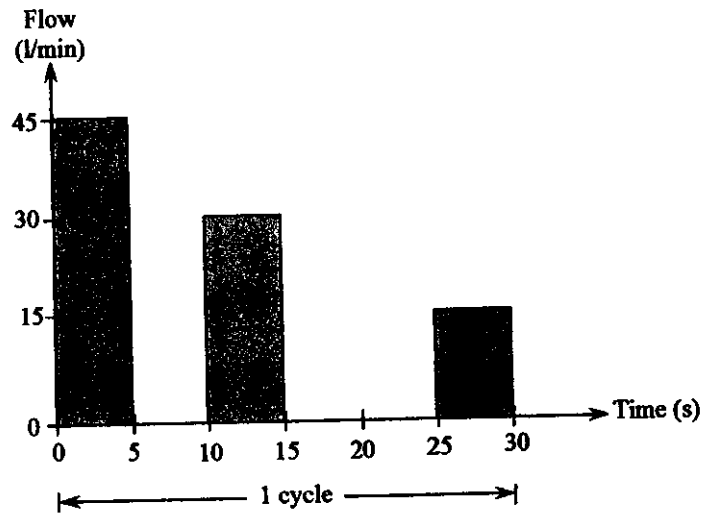


Fig. 1.

4. Explain the working of following two hydraulic circuits given in Figs. (2) and (3). And also indicate all the JIC symbols. [5+5=10]

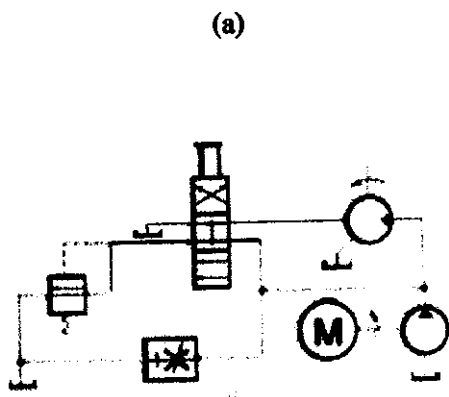


Fig. 2.

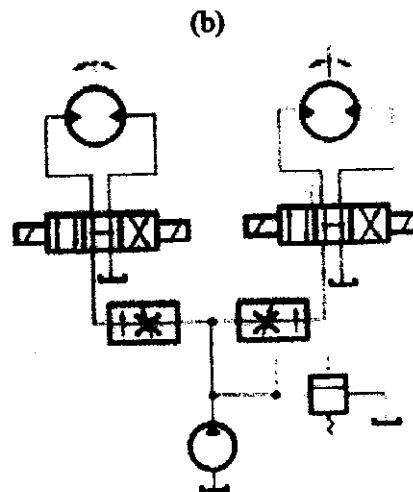


Fig. 3.
