

**AGRICULTURAL AND FOOD ENGINEERING DEPARTMENT
IIT KHARAGPUR**

Mid-Spring Semester Examination 2014-2015

1st Year M. Tech., M. S., Ph. D. and Final Year Dual Degree Students

Date of Exam: 19-02-2015 (AN)

Max. Marks: 30

Subject No.: AG60004

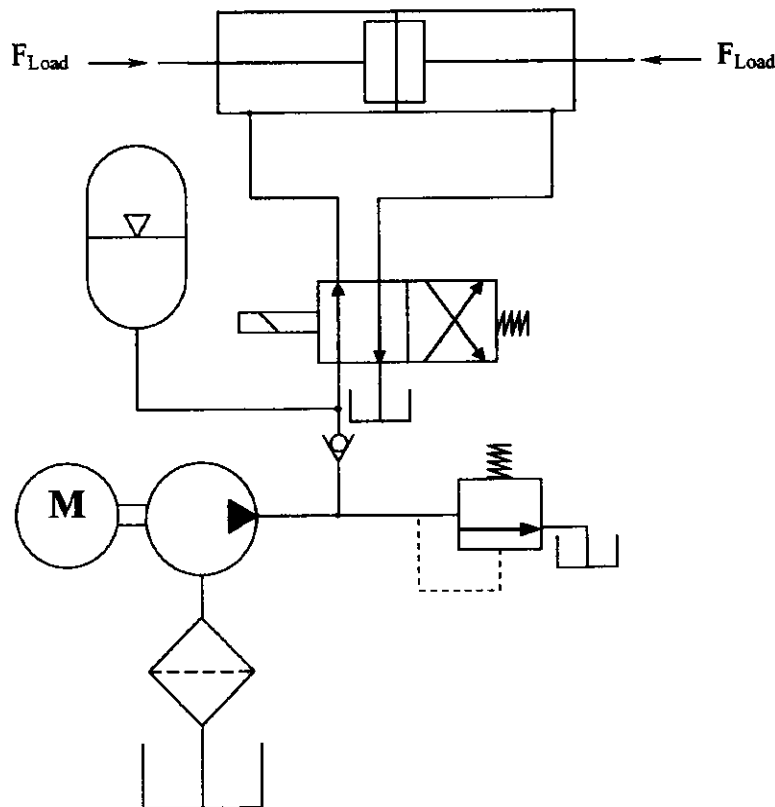
Time: 2 h

Subject Name: Tractor Systems Design II

No. of Students: 20

Instructions: Answer all the questions. Answer must be brief and to the point. Make justified assumption wherever necessary.

1. (a) Explain in detail the working of a hydraulic circuit as given in the below Figure.



- (b) A pump and accumulator power pack system working pressure is 125 bar and the maximum pressure at the accumulator is 200 bar. Assuming the accumulator pre-charge pressure is 90% of its working pressure. If maximum volume of fluid to be stored in the accumulator is 2.5 liters, determine the accumulator volume assuming isothermal charge and discharge of the accumulator. [5+4=9]

2. (a) Derive expression for the centre of gravity (CG) and moment of inertia of a tractor.
- (b) Chassis parameters of a tractor are designed as follows: wheel base is 2700 mm, CG location from rear axle centre is 780 mm and pitch moment of inertia about its CG is estimated as 6335 kg m^2 . Estimate the natural frequencies and illustrate the modes of vibration of a tractor considering it as a linear 2 degree-of-freedom system. The spring rates for a single front and a single rear tire are estimated to be 287.4 N/mm and 337.7 N/mm respectively. [7+8=15]
3. Write short notes on the following: [2×3=6]
- (a) JIC Symbols: (i) Reversible variable displacement hydraulic pump, (ii) Four port, three position, spring centered, solenoid controlled, hydraulic pilot operated directional control valve and (iii) Internally piloted pressure relief valve.
- (b) Methodology for a tractor steering system design.