

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION)**

CLASS: B.TECH
BRANCH: MECHANICAL ENGINEERING

SEMESTER: VII
SESSION: MO/2022

SUBJECT: ME403 HYDRAULIC AND PNEUMATIC CONTROL

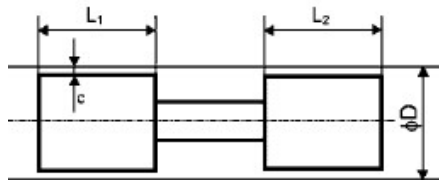
TIME: 2 HOURS

FULL MARKS: 25

INSTRUCTIONS:

1. The total marks of the questions are 25.
2. Candidates attempt for all 25 marks.
3. Before attempting the question paper, be sure that you have got the correct question paper.
4. The missing data, if any, may be assumed suitably.
5. Tables/Data handbook/Graph paper etc. to be supplied to the candidates in the examination hall.

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| Q1 (a) Prove that the internal leakage resistance (R_L) through a radial clearance between two concentric cylindrical bodies or between a spool and a sleeve is
$R_L = \frac{12\rho\nu L}{\pi Dc^3}$; where L and D are the Length of leakage path and spool diameter, respectively; ν is the kinematic viscosity; ρ is the density of the oil; c is the radial clearance. | [3] | I | III |
| Q1 (b) Write various applications of the power hydraulic system. | [2] | I | I |
| Q2 (a) A gear pump of 12.5 cm^3 geometric volume operated at 1800 rev/min delivers the oil at 16 MPa pressure. Assuming an ideal pump, calculate the pump flow rate, Q_t , the hydraulic power at the pump exit line, N_{out} , and the driving torque, T_t , if the inlet pressure is 200 kPa. | [3] | I | III |
| Q2 (b) Write the definition of a pump and provide its classification. | [2] | I | I |
| Q3 (a) Derive an expression of viscous friction coefficient (f_v) for a part moving in the oil. | [3] | II | III |
| Q3 (b) Calculate, the viscous friction coefficient for the given spool valve given: $L_1 = L_2 = 10 \text{ mm}$, $D = 8 \text{ mm}$, $c = 2 \text{ }\mu\text{m}$, $\mu = 0.02 \text{ Ns/m}^2$; where c and L are the radial clearance and length of spool land, respectively. | [5] | II | III |



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| Q4 Design and describe the working principle of a direct operated pressure relief valve with a suitable sketch and symbol. | [5] | II | III |
| Q5 Write short note:
i. Double-acting cylinder
ii. Open-loop system | [5] | III | II |