BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: M.TECH **SEMESTER : 1**
BRANCH: MECHANICAL **SESSION : MO/2025**

SUBJECT: ME526 FLUID POWER AND CONTROL

TIME: 3 Hours **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

			CO	BL
Q.1(a)	Draw a suitable sketch of an External Gear Pump, and describe its working principle.	[3]	1	II
Q.1(b)	What is Hydrostatic Transmission System (HST)? Write various applications of the HST.	[2]	1	I
Q.1(c)	A single-rod double-acting cylinder with a bore of 160 mm is required to exert a force of 200 kN on the outstroke. (a) Determine the required oil pressure in the cap end of the cylinder. (b) If the diameter of the cylinder rod of the same double-acting cylinder is 90 mm, determine the pulling force of the rod on the retract stroke with the same oil pressure, this time in the rod end of the cylinder.	[5]	1	IV
Q.2(a)	A pressure relief valve (PRV) contains a poppet with a 0.65 mm^2 area on which system pressure acts. During assembly, a spring with a spring constant of 200 N/m is installed in the valve to hold the poppet against its seat. The adjustment mechanism is then set so that the spring initially compresses 0.5 cm from its free-length condition. In order to pass full pump flow through the valve at the PRV pressure setting, the poppet must move 0.8 cm from its fully closed position. Determine the a) Cracking pressure b) Full pump flow pressure (PRV pressure setting) c) What should be the initial compression of the spring in the PRV if the full pump flow pressure is to be 40% greater than the cracking pressure?	[5]	2	IV
Q.2(b)	Describe the working principle of a pressure-compensated flow control valve. Write the difference between non-pressure-compensated flow control valve and pressure-compensated flow control valve.	[5]	2	II
Q.3(a)	In the given regenerative circuit (refer Figure 1), a double-acting cylinder having an area at piston end is 18 cm^2 and a rod end is 12 cm^2. The pump flow is 600 LPM. The force applied on the load by the piston during the extension is 200 N. Find the following parameters: (i) Piston speed during the retraction. (ii) Piston speed during the extension operation. (iii) Estimate the power generated by the piston during extension.	[5]	3	IV
Q.3(b)	Prove that the load-carrying capacity of a regenerative cylinder during extension (refer Figure 1) is less than a regular double-acting cylinder. Also, prove that load-carrying capacity of the regenerative cylinder during extension is **less** than that obtained from a regular double-acting cylinder.	[5]	3	III

PTO

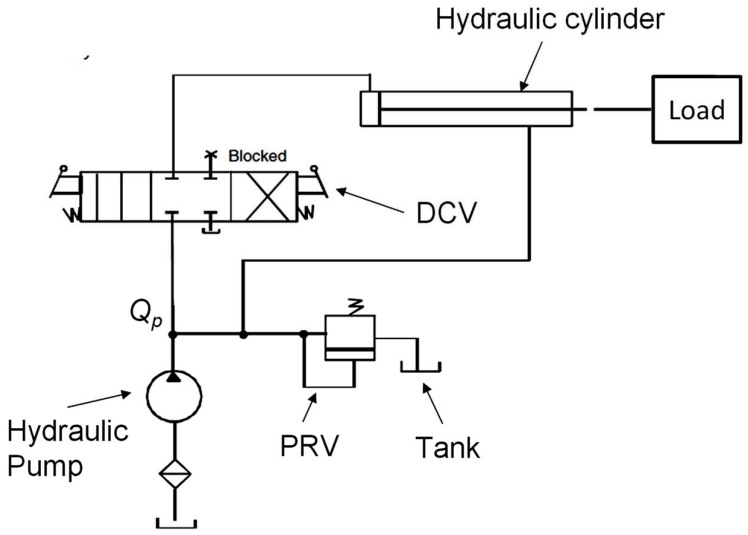

Figure 1

Q.4(a)	A gas-loaded accumulator used as an auxiliary power source in a hydraulic system (refer Figure 2). The pump supplied flow to the control valve is 5 LPM. The initial pressure and volume of the accumulator is 0.1 MPa and 0.62 m^3. Find out final accumulator pressure after changing the volume of the air is 0.2 m^3. Consider the gas works on a reversible adiabatic process.	[5]	4	IV

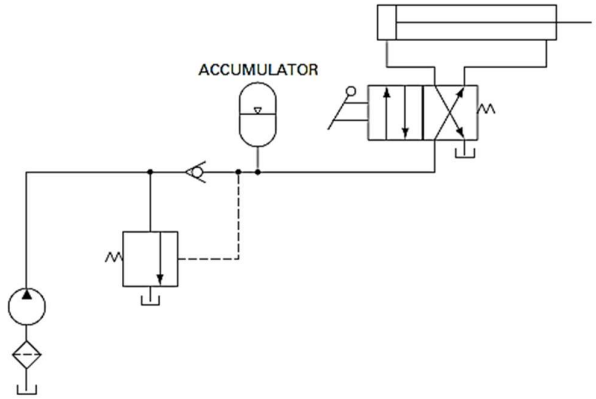

Figure 2

Q.4(b)	Prove that the maximum energy store in the accumulator is $E_{\max} = \frac{V_0 P_2}{n^{\frac{n}{n-1}}}$, where V_0 is the initial volume, and P_2 is final pressure and n is polytrophic index.	[5]	4	III
Q.5(a)	Draw the PLC ladder logic diagram rung for Z=(A+B).(C+D).E	[3]	5	II
Q.5(b)	What is Programmable Logic Controller (PLC)? What are the major units of a PLC? Describe various logic functions that are used in PLC.	[5]	5	II
Q.5(c)	Write short notes on Strainer.	[2]	5	I

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