

Question 02

Figure Q2 shows an epicyclic gear box. The pinions S_1 and S_2 are driven directly from the engine by the shaft B and gear through pinions P_1 and P_2 , with the annular wheels A_1 and A_2 . These annular wheels may be locked in turn to give two speeds to the driven shaft C. The first speed occurs when A_1 is locked and the second speed occurs when A_2 is locked. The pinion P_2 rotates freely on a pin carried by A_1 and P_1 rotates freely on a pin carried by the arm which is keyed to the driven shaft C. Assuming that the number of teeth on A_1 to be equal to that on A_2 and that the number of teeth on S_1 and S_2 to be equal, find

- the ratio of the number of teeth on A_1 to the number of teeth on S_1 when the second speed is 1.75 times the first speed and in the same direction.
- first and second gear ratio.
- first and second speeds for this ratio when the engine speed is 3400 rev/min.

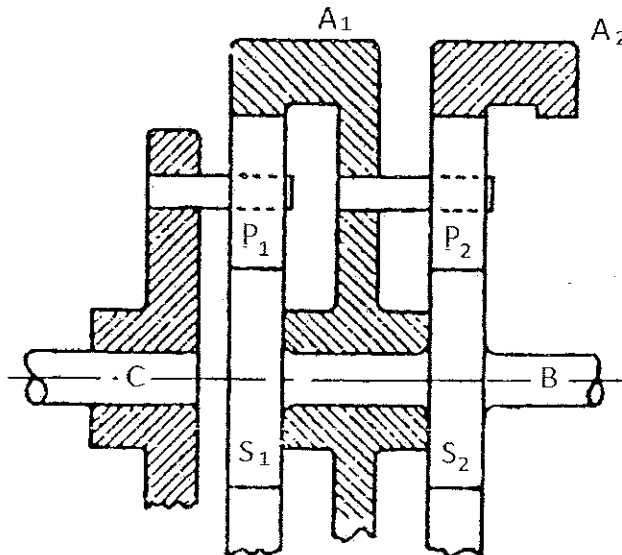


Figure. Q2

Question 03

Modern ABS/Traction control systems are capable of performing additional functions such as , Anti-Lock Braking System (ABS), Corner Brake Control, Electronic Brake Force Distribution , Automatic Stability Control , ASC Sub-functions Engine Drag Torque Reduction, Dynamic Stability Control (DSC), DSC Sub-functions Dynamic Brake System (DBS).

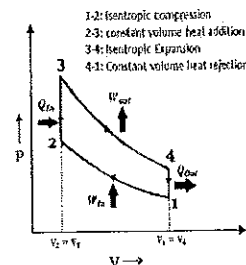
- List the sensors involved in accomplishing the above tasks in the automotive control system.
- Briefly explain each function listed above.

Question 04

- A four cylinder SI four stroke engine with a 1.8 liter displacement volume operates at Wide Open Throttle (WOT) on air standard Otto cycle at 2800 rev/min with following operating parameters.
- compression ratio - 8:1
- mechanical efficiency - 86%
- Stroke to bore ratio (s/b) - 1.12
- Air Fuel ratio - 15:1
- Heating value of fuel - 44500 kJ/kg
- You may assume that the combustion efficiency is 100%, at the start of compression stroke, conditions in the cylinder combustion chamber are 100 kPa and 60°C and 5% of exhaust residual is left over from previous cycle.

Do a complete thermodynamic analysis of the engine for one cylinder and determine the following :

- bore diameter and stroke of the engine
- V_1 T_1 P_1
- V_2 T_2 P_2
- heat added per cylinder per cycle



Question 05

- Compare and contrast the common rail diesel fuel injection system with distributor type conventional diesel fuel injection system.
- Explain the consequences of incorrect injection timing of a compression ignition system.

Question 06

- Explain the features of methanol as an alternative fuel for automobiles.
- Explain the main features and methods used for combustion in a gasoline direct injection engine.

Question 07

A six cylinder, four stroke engine of 123 mm bore, 128mm stroke and with a compression ratio of 7 is tested at 4300 rpm on a dynamometer which has 70 cm arm to measure the torque. During a test, the dynamometer torque arm scale reading was 850N and the engine consumed 1.2 kg of gasoline per minute having a calorific value of 44,000 kJ/kg. Air at 27°C and 1 bar was supplied at a rate of 15 kg/min. Find

- the brake power, kW
- the brake mean effective pressure, N/m²
- the brake specific fuel consumption, g/kWh
- the brake thermal efficiency

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