

ANSWER ALL QUESTIONS on this paper. Marks: 20% each. Total: 100%

Question 1 – Electric Vehicle Developments

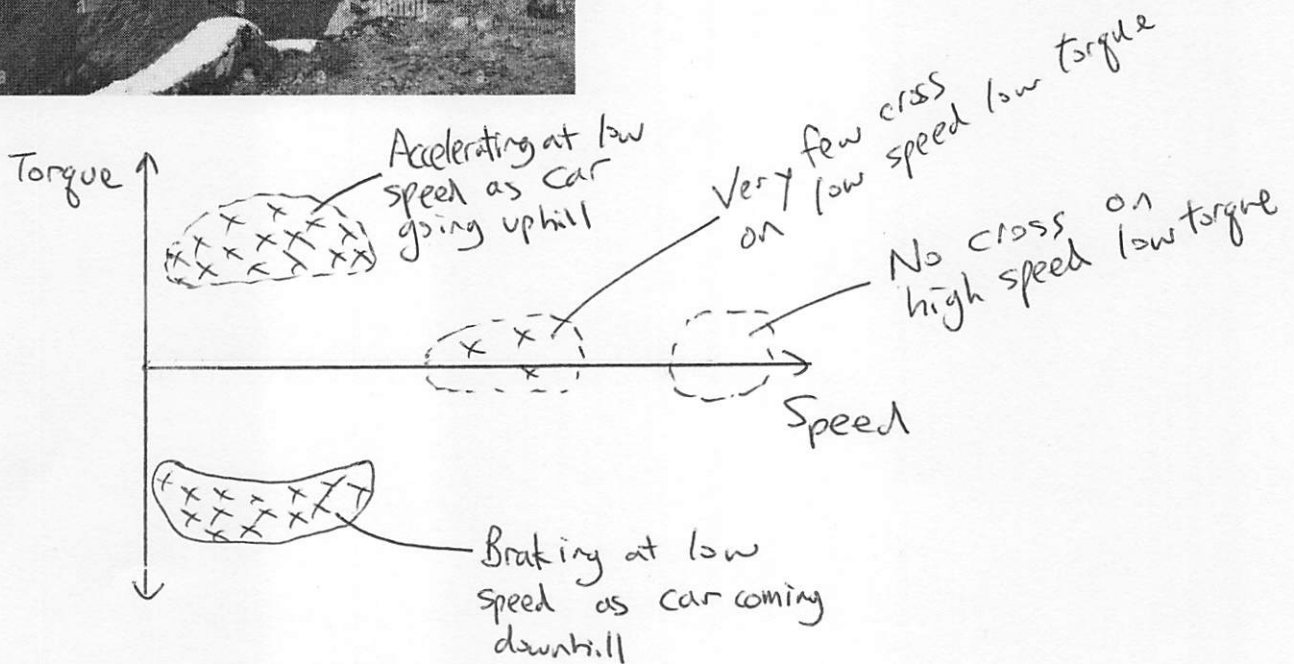


An electric vehicle is going up and down the mountain on a twisted road shown on the left picture.

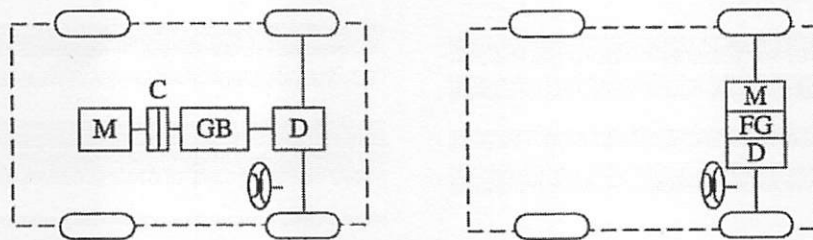
Draw a graph of "Torque-Speed Requirements of Typical Driving Cycles" for this kind of trip.

In your graph, identify and explain the driving conditions of the groups of dots.

Answer



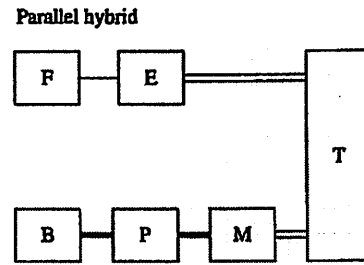
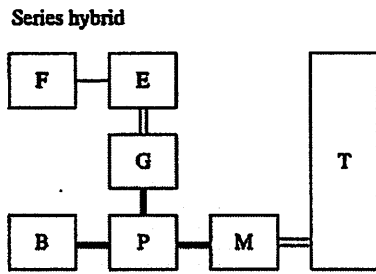
Question 2 – Electric Vehicle Systems



Give 4 key improvements the RIGHT configuration has, over the LEFT configuration, and explain why.

1. Clutch is eliminated - because motor does not need to idle when stopping.
2. Gear box is eliminated - because motor output torque is high at low speed.
3. Fixed gear is used - because electric motor has large speed range.
4. Motor arranged inline - because unlike ICE, can easily be done with electric motor.

Question 3 – Hybrid Electric Vehicles



TWO Advantages Series Hybrid has over Parallel Hybrid

1. Engine can run at constant speed.
2. Can run as pure EV, with P, B, M, with F, E, G. as backup power source

TWO Advantages Parallel Hybrid has over Series Hybrid

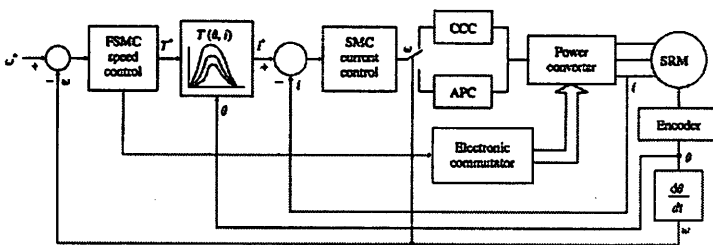
1. Two driving output, E and M
2. No need for separate generator G

Question 4 – Electric Vehicle Propulsion

4 reasons why Brush Type DC motor is not suitable for EV application:

1. The commutator limits max current
2. Heat generated in coil is difficult to dissipate
3. Commutator has reliability issue. Needs replacement.
4. The peak power, power to size ratio, is inferior to BLDC

Question 5 – Electric Motor for EV



(a) What are the major differences between CCC drive and APC drive?

CCC = current chopping control - controls the shape and timing of current supply

APC = Angular Position control - controls the on-off timing only

(b) Why is there a need for two different drive schemes (APC & CCC) in one motor drive system?

CCC : for low speed, ensure a 360° smooth torque

APC : for high speed, rotational torque will automatically be uniform only concerns with accurate on-off switching is adequate.