Mon Day 11/05/2020
Modul - Alternative Powertrain - M6X02209
Student - Toby Marshall - 1702695
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Question 1

Moss 1500 kg
Frontal Area $3m^2$
CD 0.5
DofA 1.2
Densit of Gasoline = 0.755 kg/litre
RR 0.013N/N
CVT Efficiency 80%

ICE 55 kw
Flywheel Trans Eff 90%

a) $\frac{70 kph}{3.6} = 19.4$ mps

Rolling Resistance = $1500 \times 9.81 \times 0.013$
= 191.3 N
Aero Resistance = $0.5 \times 3 \times 0.5 \times 1.2 \times 19.4^2$
= 338.7 N
Total Tractive effort = 338.7 + 191.3 = 530 N

Power = ~~$530 \times 19.4^2 = 199$ kw~~
$530 \times 19.4 = 10.3$ kw

$10.3 \times (1/0.8) = 12.88$ kW

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Question 1

b) 5000w of tractive Power to maitan vehicle SPeed
FC = 700 g/kWh

700 000 kg/kwh

Power = Force x velocity

$\frac{\text{Power}}{\text{Force}}$ = Velocity $\frac{5000}{530}$ = 9.4 m/s

9.4 x 60 x 60 = m/h = 33840 meters per hour

~~RR Energery = RRT (191.3) x 33840 = 6473592N~~

~~RRE + AR = + 338.7 = 6473930.7N~~

Total tractive Effort = 530N x 33840 = 17935200 MJ

$17935200 \times \left(\frac{1}{0.8}\right) = \frac{22419000}{3600}$ MJ

= 6227.5 w/h
6.23 kW/h

700g x 6.23 4361 g
4.36 kg

0.755 x 4.36 3.29 Littures

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Question 1

C) 55000 W 12.88 kW

55000 - 12880 = 54987.12

54987.12 x 0.9

49488 W/h 12000000 ~~120000~~

D) $\frac{12000000 J}{49488 J}$ ~~242.5 seconds~~

49488 x 3600 = 178156800 J/s

$\frac{12000000}{178156800}$ 0.06735 x 60 x 60

= 242.5 seconds

e) ~~12.88 kW~~ 6227.5 W/h = Vehicle Requirement

x 3600 = 22419000 J/h

$\frac{12000000 J}{22419000}$ = 0.535 x 60 x 60

= 1926.9 seconds

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Question 1

f) 1926.9
+242.5 = 2169.4 second

60
60 = 0.6 cycles

g) 255g/kWh @ 55kw x 255

14.01 kg per cycle
x 0.6
= 8.415 kg per hour

0.755 x 8.415 = 6.35 Litures

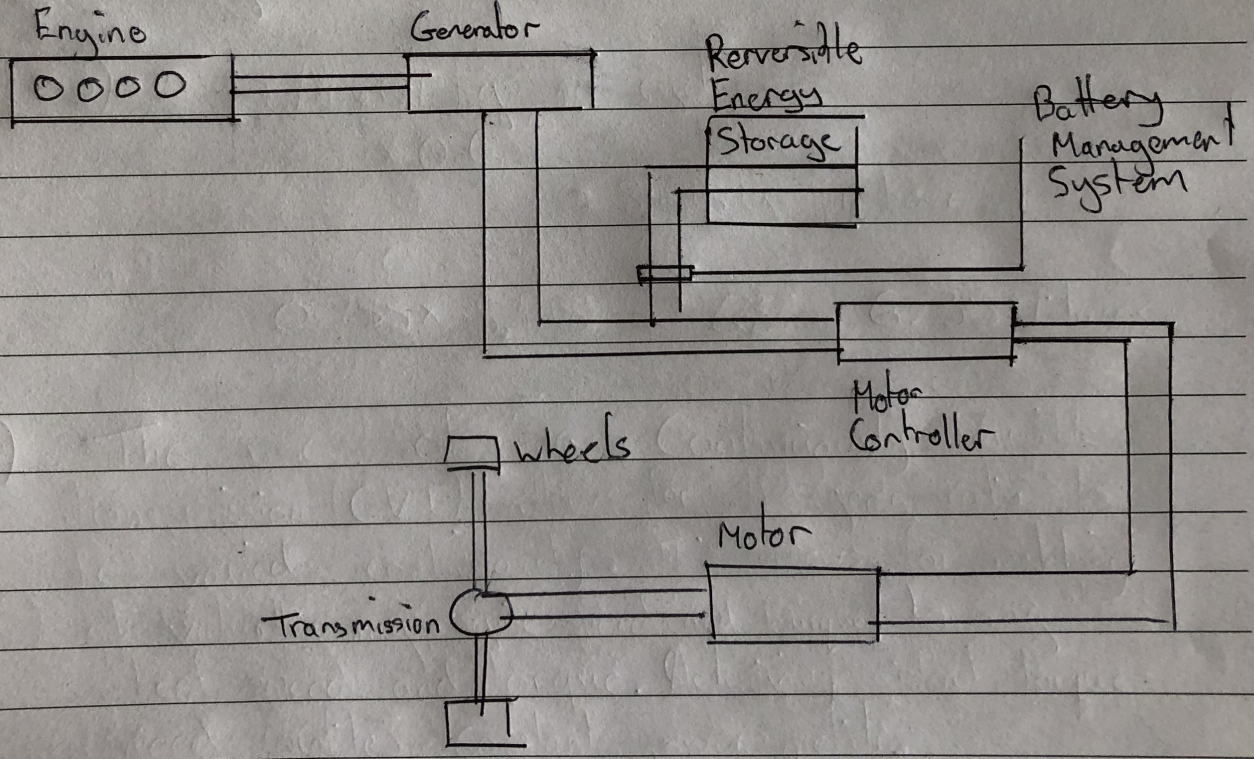
h) The use of a Continiously Variable transmission (CVT) allows for the gear ratio to be varied continuously. This allows for matching of virtually any engine speed and tourque to any wheel speed and torque. Achieving ideal torque-speed profile - constant power profile.
This means the driver will not experence any driving differences of torque or power whether the engine or flywheel is operating, & The same torque and power will be transmitted subject to requirment due to the CVT Palleys change, meaning a unnoticable change between ICE and Flywheel.

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Question 3

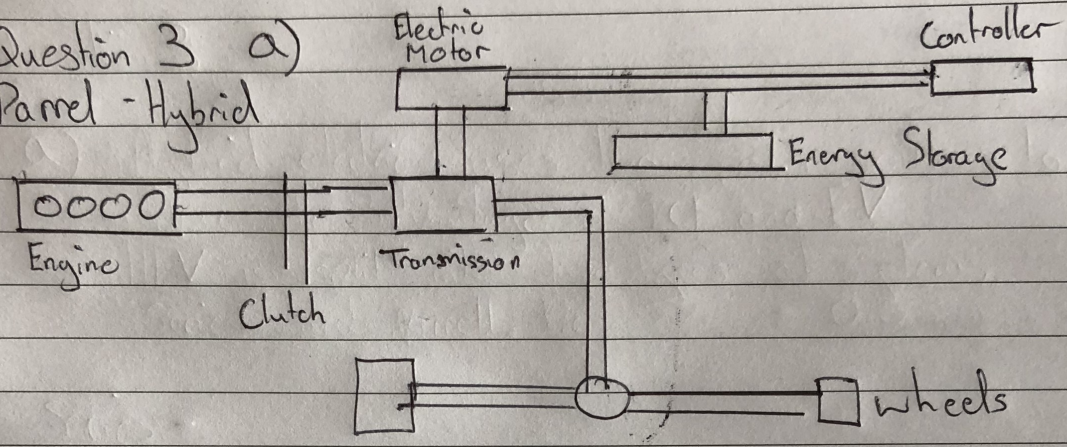
a) Hybrid electric uses two power sources to ulilize the advantages of ICE and EV
HEV is split into two types of system, Series and Parrell.

Series -



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Question 3 a)
Parrel - Hybrid



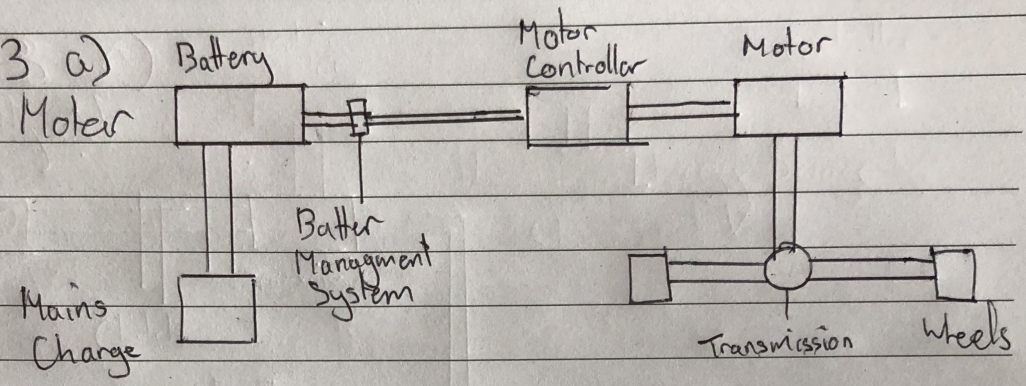
- Parrelle use mechanical drive from ICE directly to wheels via gearbo, Regerative braking can be used and motive chargery. The electric motor is attache mechanically to gearbox of the vehicle.

- Series Hybrid uses electric motors to drive wheels, can be used with just electric vehicle with ICE acting as arange extender, allows the ICE to operate at its most efficient operating / BSFC window to charge batteries, better fuel eccomany and emissions.

Electric System allows the vehicle to aperate using eletric motors to drive the wheels and batties charged from a extenal Scorce or regenerative such as KERS. Can have limited range before recharge is needed Batteries will increase the kurb weight of the vehicle.

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(Question 3 a)
Electric Motor



Fuel Cell

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Question 3

b)

Energy Storage -

Battery teenology, Lithium Ion has a ~~Torque~~ High energy density, high power power density, Lithium Ion has a high ~~battery~~ purchase cost, requires complex battery managment. Recoverable kinetic energy. Battery size depends of cycle lengtte

Gasoline has a very high energy dersity, and ~~and power~~ has a low cost for implcation on a vehicle. Long cycle lenghth

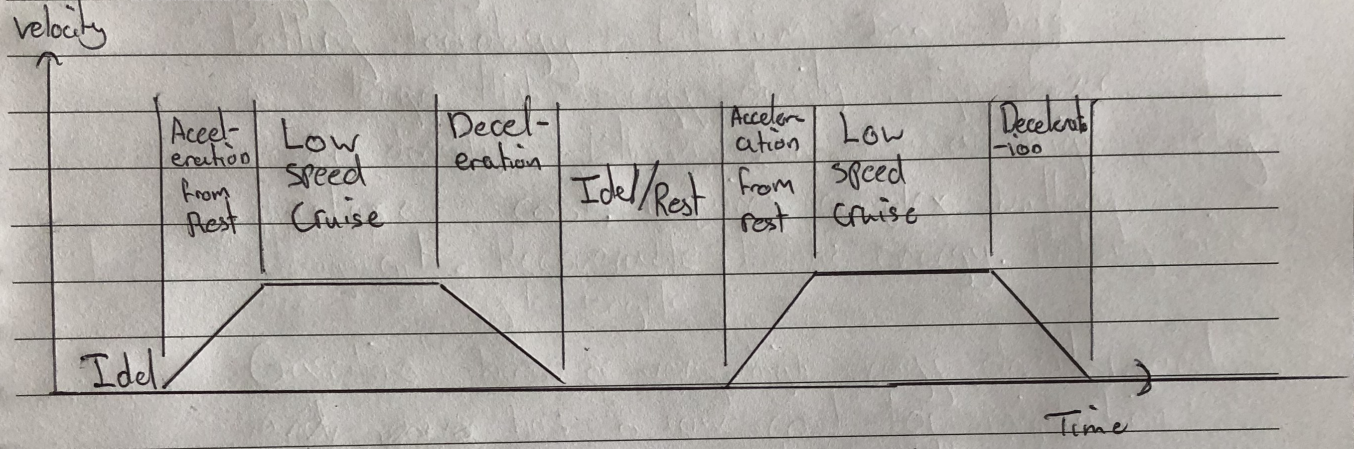
Flywheels has a rather low energy dersity output however for a flat 2ed making short distances this would be adiquit. Recoverad kinetic energy

Super capacitors ~~was~~ provid a High power output and hight power dersity, however these ~~dont~~ have a lower energy dersty provid a short cycle life.

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Question 3

c)



The drive cycle has a low speed cruise as the vehicle only travels 15miles from Base within the city of Swansea. The cycle shows a stop to when the Flat bed stops to do work before it returns to base. ~~The cycle has~~.

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Question 3

d) A Series Hybrid would be a ideal requirment for a Flatbed Van.
The Flatbed hees low speed and pows so could use large battery to support not using ICE to reduce running costs and emmissions.
ICE will be operaten at optimum efficeney providing better fuel consumption.
- Hybrid Steres will have less batteries than all full EV system which will keep kerb weght down so the flatbed can still operate carrying lawnmower which are heavey.

Engine could be switche off when stationary with all ancillaries electric, meaning les emmisions produced.
A greener image would be presentas the ICE would not be running all Contantly producing less emissions and noice.
- A High efficiency ICE unit like a turbo diesl could be used as a lower power is required to recharge batteries.
- Possible for a plug-in charge at base overnight for a initial Charge to reduce emissions produced from ICE.