

22 MAY 2018

N.B.: 1. Q. 1 is compulsory

(Time: 3 Hours)

Q. P. Code: 18161
[Maximum Marks: 80]

ASHI, NAVI MUMBAI

2. Answer any three out of remaining five questions
3. Assumptions made should be clearly stated.
4. Assume any suitable data wherever required but justify the same.

- 1 (a) What is the need and importance of electric and hybrid electric vehicle 05
(b) State and explain the dynamic equation of vehicle motion 05
(c) What are the requirements of energy supplies and energy storages in electric and hybrid electric vehicles 05
(d) Comment on the suitability of DC and AC machines for electric and hybrid electric vehicle applications 05
- 2 (a) Explain the term rolling resistance and aerodynamic drag in vehicles and derive the expression for vehicle translational speed from fundamentals 10
(b) Draw and explain the ideal traction power plant characteristic and various power source characteristics used in electric and hybrid electric vehicles 10
- 3 (a) Enlist the different architectures of hybrid electric drive train and explain the series hybrid electric drive train. 10
(b) A series hybrid electric drive train has following design specifications 10
- Parameters:*
Vehicle total mass = 1500kg; Rolling resistance coefficient = 0.01
Aerodynamic drag coefficient = 0.3; Front area = 2.0m²
Transmission efficiency (single gear) = 0.9; Electric motor efficiency = 0.85
Vehicle mass factor, $\delta = 1.067$; Air-density = 1.202kg/m³
- Performance specifications:*
Acceleration time (from 0 to 100km/hr) = 10 ± 1sec
Maximum gradeability = 30% at low speed and 5% at 100km/hr
Maximum speed = 160km/hr
Vehicle speed corresponding to motor base speed = 50km/hr
Final speed of vehicle = 100km/hr
- Obtain the (a) traction motor size, (b) engine/generator size, and (c) power capacity of peaking power source (PPS)
- 4 (a) Explain the two quadrant operation of chopper DC motor drive with suitable waveforms for electric vehicle. 10
(b) A dc separately excited motor is powered by a dc to dc converter from a 600 volts dc source. The armature resistance is 0.05Ω. The back emf constant of the motor is 1.527V/A-rad/sec. The average armature current is 250 amps. The field current is 2.5 amps. The armature current is continuous and has negligible ripple. If the duty cycle of the converter is 60%, determine (a) the input power from the source, (b) the equivalent input resistance of the dc-dc converter drive, (c) the motor speed, and (d) the developed torque. 10
- 5 (a) Explain the maximum SOC of PPS and engine on/off control strategies of the hybrid electric vehicle? 10
(b) Explain fuel cell and flywheel as energy source elements in electric and hybrid electric vehicle 10
- 6 (a) Draw and explain the typical CAN system of an hybrid electric vehicle 10
(b) Classify and explain the basic principle of Rule based energy management system. Elaborate on any one of the Rule based energy management system 10