Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

VII SEMESTER B.TECH. (AUTOMOBILE ENGINEERING)

END SEMESTER EXAMINATIONS, NOV/DEC 2018

SUBJECT: ELECTRIC AND HYBRID VEHICLES [AAE 4021]

REVISED CREDIT SYSTEM
(29/11/2018)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.

1A. A car has a drag coefficient of 0.28 and a frontal area of $2m^2$, and is traveling at 30 mi/h, and ρ=1.2 kg/m^3. Calculate max tractive effort for dry and wet road condition with coefficient of road adhesion 0.85 and 0.65 respectively for front wheel drive with L_a = 0.8m. Consider wheel base 1.8m, c.g height as 0.3m is same as hw, vehicle mass as 850kg, road angle 8^0, r_{dym} = 0.289m, f_r= 0.022 and λ=2.35. **(05)**

1B. A car has a drag coefficient of 0.23 and a frontal area of $2.2m^2$, and is traveling at 38 mi/h, and ρ=1.2 kg/m^3, Calculate the torque transmitted, gradeability and acceleration performance of the car. Consider the mass as 1205 kg, efficiency of the drive line as 65%, torque produced by engine as 120 Nm, Speed input to gear box is 2800rpm and output speed as 2000rpm with input gear teeth of 35, and final drive ratio as 8. Take f_r = 0.01, Dynamic radius as 318mm for 185 R15 tyre. **(05)**

2A. Discuss the initial acceleration component with respect to EV powertrain sizing. **(04)**

2B. An 85 Ahr (8-hour rating) battery, also has a capacity of 50.3 Ahr at the 1-hour rate. Calculate the Peukert Coefficient from two Ahr ratings mentioned. **(03)**

2C. List and explain any 2 computation strategies followed in Battery Management System. **(03)**

3A. Contrast the differences between star connection starter circuit and delta connection starter circuit. **(03)**

3B. Sketch and explain the wiring circuit for BLDC synchronous motor. **(03)**

3C. Sketch and discuss the construction and working of squirrel cage type induction motor. **(04)**

4A. In an epicyclic gear train, the internal wheels A and B and compound wheels C and D rotate independently about axis O. The wheels E and F rotate on pins fixed to the arm G. E gears with A and C and F gears with B and D. All the wheels have the same module and the numbers of teeth are: T_C = 28; T_D = 26; T_E = T_F = 18. **(05)**

i. Sketch the arrangement;

ii. Find the number of teeth on A and B;
iii. If the arm G makes 100 r.p.m. clockwise and A is fixed, find the speed of B; and
iv. 4. If the arm G makes 100 r.p.m. clockwise and wheel A makes 10 r.p.m. counter clockwise; find the speed of wheel B.

4B. Sketch and explain the wiring diagram of centralized flyback DC/DC converter. **(03)**

4C. List the characteristics of power BJT type of switch. **(02)**

5A. Discuss fuel cell characteristics. **(04)**

5B. Explain the ultracapacitor structure in terms of electric double layer capacitance. **(03)**

5C. Draw the layout of compressed air vehicle and its supply of energy and explain the same. **(03)**