Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent institution of MAHE, Manipal)

VII SEMESTER B.TECH. (MECHATRONICS ENGINEERING)

END SEMESTER EXAMINATIONS, NOV-DEC 2018

SUBJECT: HYBRID AND ELECTRIC VEHICLES [MTE 4004]

(01/12/2018)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Data not provided may be suitably assumed

1A. The engine of the car has four cylinders of 68 mm bore and 75 mm stroke. The compression ratio is 8. Calculate the cubic capacity of the engine and the clearance volume of each cylinder. **04**

1B. Differentiate with neat sketches between conventional multi-gear transmissions with clutch and integrated fixed gearing with differential. **06**

2A. Construct the flow diagram required towards the design considerations in adopting a switch reluctance motor and identify the stage for performance prediction. **05**

2B. Formulate the mass flow of the fuel in a fuel cell system through the fuel cell stack diagram. **05**

3A. Construct a Series HEV which is sized with primary steady power source and dynamic secondary power source. **04**

3B. Draw an electrical propulsion subsystem. **02**

3C. List out various Gas & Liquid Fuels, and discuss the cost estimation factors of electricity versus Carbon fuels. **04**

4A. Explain the working of Hydrogen fuel cell and compare with AFC, PAFC, SOFC, MCFC. **05**

4B. Describe the various concepts of hybrid energy storage operations with unit step current charge and discharge curve. **05**

5A. Calculate the output resultant torque and speed for a gear box having three gears, where Z_1=6, Z_2=9, Z_3=12. Plot speed-torque graph over specified time intervals by considering T_{in1} from 15 to 35 for 5 intervals and, where ω_{in1} = 1000rpm T_{in2} = 50Nm & ω_{in2} = 500rpm. **05**

5B. Identify an application for speed coupling HE drive trains using planetary gear and construct the source switching operation between primary & secondary power source. **03**

5C. Define the following: **02**

a. Base Speed.
b. Tractive effort.
c. Powertrain.
d. Auxiliary subsystem.