Reg. No.										

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

VII SEMESTER B.TECH. (MECHATRONICS ENGINEERING)

END SEMESTER EXAMINATIONS, DEC 2019

SUBJECT: HYBRID and ELECTRIC VEHICLES [MTE 4004]

(02/01/2020)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

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

1A.	Discuss charge equalization in batteries and its importance in Battery Management System. Identify various power topologies required in battery system for various charging systems in PEV. Explain various battery parameters.	**08**	**CO4**
1B.	A vehicle is having the following specifications: Mass = 1500 kg, Cd=0.26, A=2.16, ρ=1.27, fr=0.01 a. Estimate the vehicle cruising speed in kmph when total resistive power is 10kW. b. Estimate the resistive power when vehicle is at 100kmph and has the gradeability to cover vertical elevation of 3.411m with the horizontal distance of 20m.	**02**	**CO2**
2A.	Describe the working principles, advantages and disadvantages of Lead-acid and Li-Ion battery technologies	**06**	**CO4**
2B.	Elucidate why Electric Motor characteristics are more apt for EV than IC Engine	**04**	**CO2**
3A.	A hybrid vehicle having large grade has the following specifications: Maximum cruising speed at 100kmph, radius of tyre 30.9cm, gear ratio of 3.5. The vehicle exhibits the torque speed characteristics as depicted in Fig. 3a. Calculate the rated power of the Induction motor used. If the motor is replaced with Switched Reluctance Motor with same power rating and maximum cruising speed, then draw the motor characteristics to meet the EV characteristics.	**03**	**CO2**

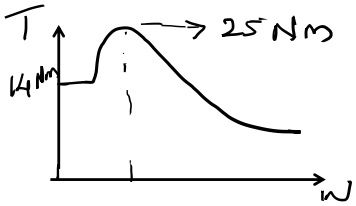

Fig. 3a

3B.	Describe the working principle and control of separately excited DC Motor to achieve EV characteristics.	**05**	**CO3**
3C.	Discuss the torque equation of switched reluctance machine and brief on operation of SR-Machine operating as motor and generator. If the SR machine is having rated power of	**02**	**CO3**

4kW and draws the current of 18A rated peak current, calculate the rate of change of Inductance.

4A.	Outline constructional and types of Permanent magnet motor drives. With neat waveforms explain which of the permanent magnet motor type is preferred. What are advantages and disadvantages of Brushless PM Motor.	**05**	**CO3**
4B.	Discuss various historical significances happened in vehicle technologies. Classify and explain the vehicle technologies and their current alternative energy sources.	**05**	**CO1**
5A.	"Energy within the vehicle is the key need in EV technologies", discuss the statement.	**02**	**CO1**
5B.	Plot and discuss the efficiency maps of IC Engine and Electric Motors	**03**	**CO3**
5C.	Define Hybridness and describe the Hybridness in Parallel HEV configuration and justify "why the IC engine is to be operated at 3500rpm and MG at 750rpm" in parallel HEV. For a HEV AWD vehicle having hybridness of 57.14% is running with a ICE of 75kW at 3500rpm, estimate the wheel motor power that is run at 750rpm. What if the hybridness is mild, calculate the IC engine power.	**05**	**CO4**