Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

VII SEMESTER B.TECH. (AUTOMOBILE ENGINEERING)

END SEMESTER EXAMINATIONS, JAN-FEB 2021

SUBJECT: ELECTRIC AND HYBRID VEHICLES [AAE 4021]

REVISED CREDIT SYSTEM
(01/02/2021)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitable assumed.
- Draw sketches neatly using instruments.

1A. Compare conventional vehicles and Electric vehicles, based on (i) Well- wheel efficiency (ii) Maintenance involved (iii) N-V-H characteristics (iv) Pollution tendencies 4M;CO1;L2

1B. With a circuit diagram, illustrate the working principle of a regeneration braking as applicable in Electric vehicles. 3M;CO3;L4

1C. Illustrate the special features of hybrid electric vehicle engine systems based on Atkinson cycles. 3M;CO3;L2

2A. Define the motor speed ratio. Discuss the effect of motor speed ratios (Low, medium, high) for the selection of gear ratios in the gear box in case of electric vehicles.5M;CO1;L4

2B. Rate the centralised traction motor for a proposed electric vehicle which is required to accelerate from 0-96 kmph in 10 seconds. Consider GVM of EV as 1300 KGS, which has a single fixed gearing as transmission. Adapt a motor speed ratio of 4 and base speed as 1150 rpm. Wheel radius is 30 cm. Rotational factor=1.11. check the adequacy of the motor for the following condition.

(i) A maximum speed of 80 MPH

(ii) Find the gradeability of the EV at 20 kmph.

Consider air drag coefficient as 0.22, density of air as 1.16 kg/m^3, projected frontal area as 1.8 m^2, rolling friction coefficient as 0.01, Transmission efficiency as 95%. 5M; CO2;L4

3A. What are the features of metal air batteries? Explain the principle of working of such a battery proposed as a likely energy storage system for futuristic EVs. 4M;CO4;L2

3B. Discuss with characteristics, how the torque and speed can be controlled in D C motors. 3M; CO3;L2

3C. Illustrate the process followed in the industry, to rate the engine for a proposed new model of hybrid electric vehicle. 3M;CO2;L4

4A. Tractive resistance encountered by a hybrid electric vehicle of mass 7000 KG on level road is modeled as $0.0112mg+0.00006mgV+0.0268AV^2$, where m(mass) in KG, g=9.81 m/s^2, V-speed in kmph, A- area in m^2 . The frontal projected area of vehicle is 6 m^2. The transmission efficiency in top overall gear ratio 6.2:1 is 90% and in second overall gear ratio of 15:1 is 80%. If the maximum top gear speed is 90 kmph, Find the following.
(i) Demand power (ii) Engine speed if the wheel diameter is 82 cm (iii) Maximum grade negotiable in above engine speed in second gear (iv) Maximum draw bar pull in low gear. 4M;CO1; L4

4B. What are the requirements of vehicle control systems? Illustrate with a block diagram, the implementation of a fuzzy logic control system strategy for the optimum usage of engine power and motor power for different modes of operations in an HEV. 4M;CO5;L4

4C. Discuss the significance of the following w r t energy storage systems (i) Constant current discharge test (ii) Ragone plots. 2M;CO4;L3

5A. With power flow diagrams, illustrate prominent modes of operations in a parallel hybrid vehicle. 4M;CO2;L2

5B. What are speed coupling devices? With a neat sketch, explain the working of a speed coupling device using the planetary gears. 3M;CO2;L3

5C. Discuss the principle of MOSFET as a solid-state switch. Adapting such a switch, illustrate the working of a power electronic converter. 3M;CO5;L4