



# CBCS SCHEME

18EE646

## Sixth Semester B.E. Degree Examination, July/August 2022 Electric Vehicles Technologies

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

### Module-1

- 1 a. With the help of block diagram, explain possible Electric Vehicle Configuration (Any five models). (10 Marks)
- b. List the various drive cycle or schedules that have been developed to emulate typical traffic environment. (05 Marks)
- c. Discuss the battery power output, regeneration braking power and net energy consumption from the battery. (05 Marks)

OR

- 2 a. With help of block diagram, explain the configuration of series hybrid drive train and hence discuss the seven operating modes controlled by vehicle controller of hybrid electric vehicle. (10 Marks)
- b. With the help of curves, explain the load power decomposition into steady and dynamic components. (05 Marks)
- c. What is a transmotor? Explain the speed relationships and torque relationship with respect to inner rotor, outer rotor and airgap parts. (05 Marks)

### Module-2

- 3 a. Explain the various components of a battery cell and list the major types of rechargeable battery considered for EV and HEV applications. (08 Marks)
- b. Explain the cell discharge operation of a lead acid battery with chemical reaction equations. (04 Marks)
- c. Explain the following parameter with respect to the battery
  - i) Battery capacity
  - ii) State of Charge (SOC)
  - iii) State of Discharge (SOD)
  - iv) Depth of Discharge (DOD). (08 Marks)

OR

- 4 a. Explain the significance of Ragone plots using Battery capacity measurement in battery technology and hence relate the specific energy, specific power and curve fitting constant. (06 Marks)
- b. With the help of chemical reaction equation, explain the basic fuel cell structure and hence discuss the fuel cell characteristics. (08 Marks)
- c. Explain super capacitor and ultra capacitors with respect to their power and energy capacity. (06 Marks)

### Module-3

- 5 a. Explain the functional block diagram of an EV propulsion system and hence discuss the various choices of electric propulsion for EV consideration. (10 Marks)
- b. Explain the concept of EV by comparing the following terms
  - i) EV motor and Industrial motor
  - ii) Single and dual motor configuration
  - iii) Geared and Gearless motor (10 Marks)

OR

- 6 a. With the help of circuit diagram and operating characteristics, explain the two quadrant zero voltage transition converter for EV DC motor drives. (10 Marks)
- b. With the help of block diagram and XY and  $\alpha\beta$  frame plots, explain Field Oriented Control (FOC) of Induction motor drive. (10 Marks)

**Module-4**

- 7 a. With the help of plot and control flow chart, explain the maximum SOC PPS control strategy applied to series hybrid drive trains. (10 Marks)
- b. With the help of speed torque characteristics, power rating to traction power versus speed ratio of a drive train, explain the power rating design of the traction motor. (10 Marks)

OR

- 8 a. List the major advantages of a torque coupling parallel configuration over a series configuration and hence explain the configuration of the parallel torque coupling hybrid drive train using block diagram. (10 Marks)
- b. Explain the following with respect to Design of a Drive train
- Engine power Design with power versus speed plot
  - Transmission design
  - PPS design with energy equations.

CMRIT LIBRARY  
BANGALORE - 560 037

(10 Marks)

**Module-5**

- 9 a. Explain the following method of charging with charging plot
- Constant Voltage charge (CV)
  - Constant Current charge (CC)
  - Pulls charges
  - Reflex charge
  - Float charge
- b. Explain the following termination methods of a battery power
- Time
  - Voltage
  - dv/dt
  - Current
  - Temperature.

(10 Marks)

(10 Marks)

OR

- 10 a. Explain the problems encountered with respect to charging from grid
- Line Stability issues
  - Inverters distortion and DC current injection
  - Local distortion configuration.
- b. Explain Non isolated grid tied Z-converter and Grid tied Z-converter with isolated charger and discuss the advantages and draw back isolated of these Z-converter. (10 Marks)

(10 Marks)

(10 Marks)

\*\*\*\*\*