UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2021

Course: Electric Vehicle Technology
Program: B. Tech (Automotive Design Engineering)
Time: 03 hrs.
Instructions: All Section are compulsory

Semester: VII
Code: MEAD 4010
Max. Marks: 100

SECTION A (5Q × 4M = 20 Marks)
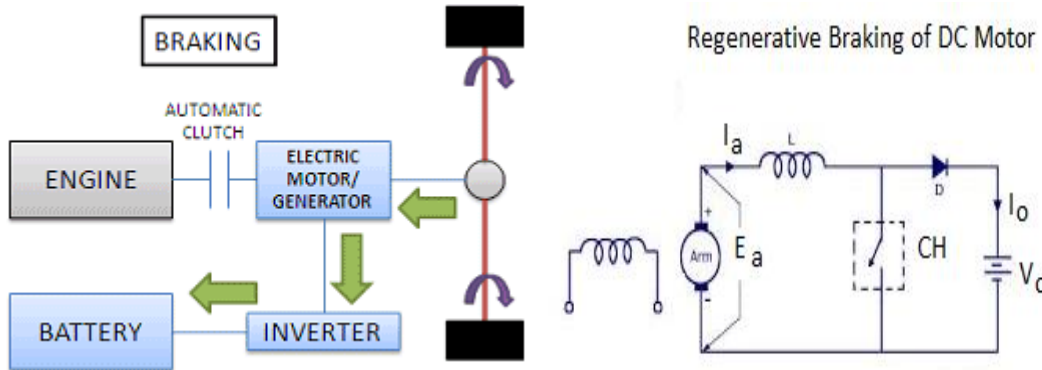
S. No.		Marks	CO
Q 1	Explain energy storage requirements in hybrid and electric vehicles.	4	CO1
Q 2	What is meant by Peukert capacity of a battery? What is its significance?	4	CO2
Q 3	Illustrate different drive train used in HEVs systems.	4	CO1
Q 4	Define the terms specific energy and energy density as applied to battery technology.	4	CO3
Q 5	Explain the speed control methods (armature control and field control) used in the electric vehicle for traction motor.	4	CO3

SECTION B (4Q × 10M = 40 Marks)

Q 6	Explain the operation of full wave rectifier with RL and freewheeling diode load with suitable waveforms for electric vehicles.	10	CO2
Q 7	What is its typical rating of Induction Motors used in HEV applications?	10	CO3
Q 8	Comment on the suitability of DC and AC machines for electric and hybrid electric vehicle applications also compare the relevant features of different motor types.	10	CO4
Q 9	What are different modes of charging batteries used in EVs? Compare them in detail through tabular column. **OR** A 12V battery pack is connected to series RL load with L=100mH.The battery pack has rated capacity of 120Ah. At t=0 switch is closed and the battery begins to discharge. a) Calculate and plot battery discharge current i(t), if the steady state discharge is C/5. Neglect voltage drop. b) Calculate and plot SoC, assuming that t=0, the battery is charged to rated capacity. c) Calculate the time according to 70% DoD, assume t>>100ms.	10	CO4

SECTION-C (2Q × 20M = 40 Marks)

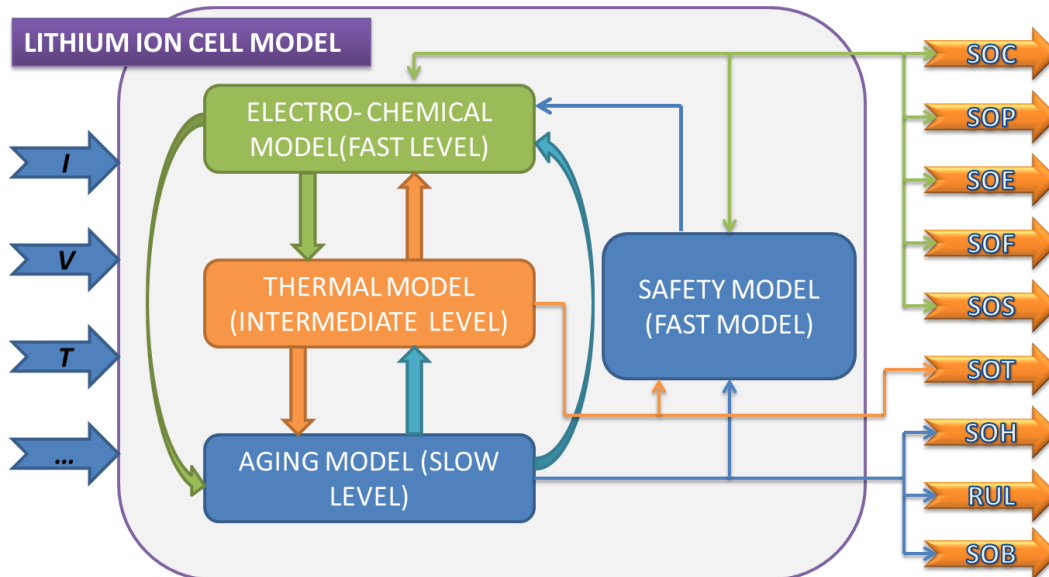| Q 10	Explain the forward motoring and regenerative (forward) braking control of a dc motor with a single chopper. Give circuit diagram, and show the quadrants of operation. Design a regenerative braking circuit using step-up chopper used in mild hybrid electric vehicle system is represented with below figure also explain its characteristics with neat sketch.	20	CO3
Q 11	Design and describe the working of a single-phase one-pulse SCR controlled rectifier with RLE load through the neat circuit and appropriate waveforms of supply voltage, load voltage, load current and voltage across the SCR. Also, derive expression for the average voltage, RMS voltage, load current in terms of supply voltage, load impedance, firing angle. **OR** In the battery management system (lithium ion battery model), elucidate SOC, SOP, SOE, SOF, SOS, SOT, SOH, RUL and SOB. How these parameters are helpful in the electric vehicle with respect to energy management system.	20 20	CO4