Roll No												

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

TEST 1

Winter Semester: 2021 - 22
Course Code: EEE3036
Course Name: Battery Management Systems
Program & Sem: B.Tech & IV Sem

Date: 28th April 2022
Time: 3:00 PM o 4:00 PM
Max Marks: 30
Weightage: 15%

Instructions:
(i) Read the all questions carefully and answer accordingly.
(ii) All of you should bring your calculator

Part A [Memory Recall Questions]

Answer all the Questions. Each question carries THREE marks. (3Qx 3M= 9M)

Q.NO.1 Draw the equivalent circuit of a Battery. (C.O.No.1) [Knowledge]

Q.NO.2 List any three types of EV Battery. (C.O.No.1) [Knowledge]

Q.NO.3 Explain the concept of SoC. (C.O.No.1) [Knowledge]

Part B [Thought Provoking Questions]

Answer both the Questions. Each question carries SIX marks. (2Qx6M=12M)

Q.NO.4 Battery equivalent circuit models (ECMs) are widely employed in online battery management applications. The model parameters are known to vary according to the operating conditions, such as the battery state of charge (SOC). Therefore, online recursive ECM parameter estimation is one means that may help to improve the modelling accuracy. Referring to the figure 1 explain identify the model used above and explain it. (C.O.No.1) [Comprehension]

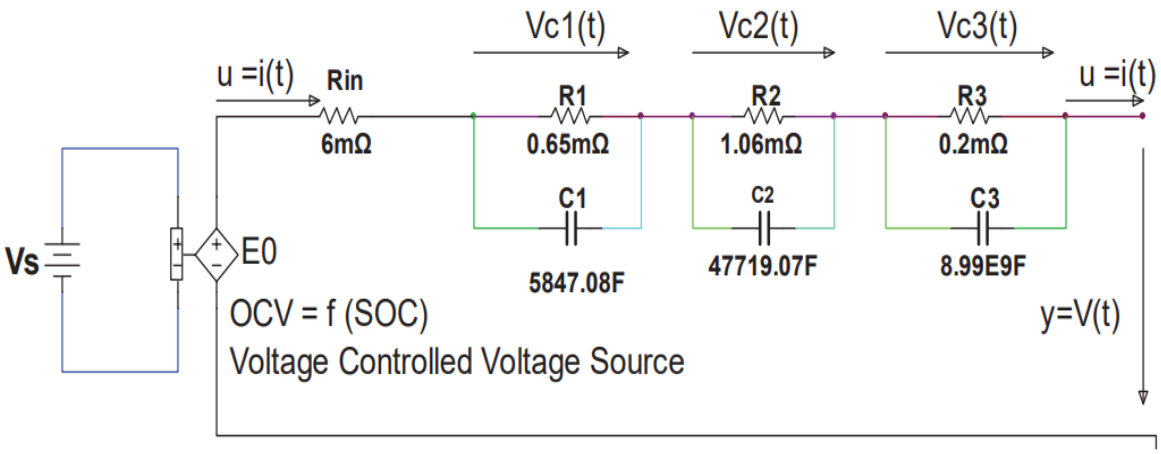

Figure 1

Q.NO.5 The circuitry to recharge the batteries in a portable product is an important part of any power supply design. The complexity (and cost) of the charging system is primarily dependent on the type of battery and the recharge time. Explain the charging topology and the controller used here with the help of conceptual facts and theories. (C.O.No.2) [Comprehension]

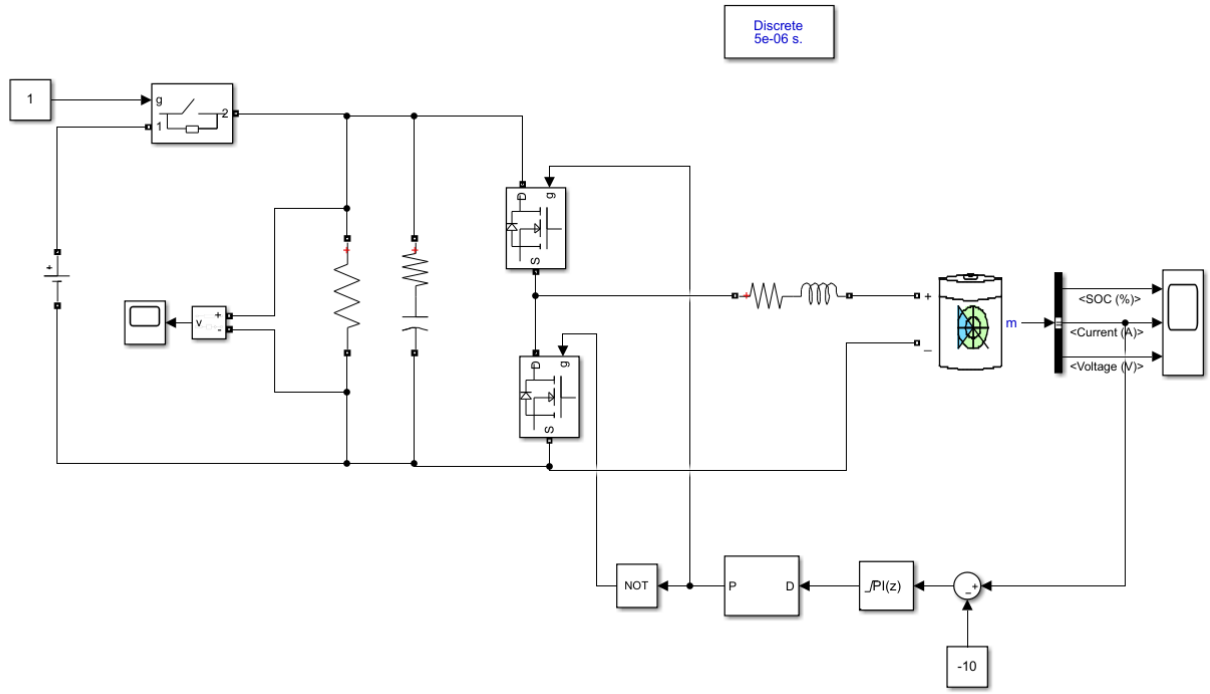

Figure 2

Part C [Problem Solving Questions]

Answer the Question. The question carries NINE marks. (1Qx9M=9M)

Q.NO.6 A Li-ion battery is intended to be discharged using a bidirectional DC-DC converter circuit at constant current with the help of a PID Controller for 2 hours. The initial SOC is 0.8. The battery capacity is 100 Ah and rated voltage is 12 V. The load current is constant at 10 A.

a) Identify the unknown parameters that could be computed from the given data.

b) Compute the unknown parameters.

(C.O.No.2) [Application]

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SCHOOL OF ENGINEERING

TEST 2

Winter Semester: 2021 - 22
Course Code: EEE3036
Course Name: Battery Management Systems
Program & Sem: B.Tech(EEE) & IVth Sem

Date: 03-06-2022
Time: 3 pm to 4 pm
Max Marks: 30
Weightage: 15 %

Instructions:

(i) Read the all questions carefully and answer accordingly.

(ii) All of you should bring your calculator

Part A [Memory Recall Questions]

Answer all the Questions. Each question carries THREE marks. (3Qx 3M= 9M)

1 State four topologies of BMS (C.O.No.3) [Knowledge]

2 List out any three roles of master BMS (C.O.No.3) [Knowledge]

3 State the concept of sensing temperature in BMS. (C.O.No.3) [Knowledge]

Part B [Thought Provoking Questions]

Answer both the Questions. Each question carries SIX marks. (2Qx6M=12M)

4 Mahindra & Mahindra wants to employ some specific method to measure the current delivered by the battery pack to the load to ensure longer state of health of battery pack. State any two methods to estimate the current of battery pack with neat sketch diagram. (C.O.No.3) [Comprehension]

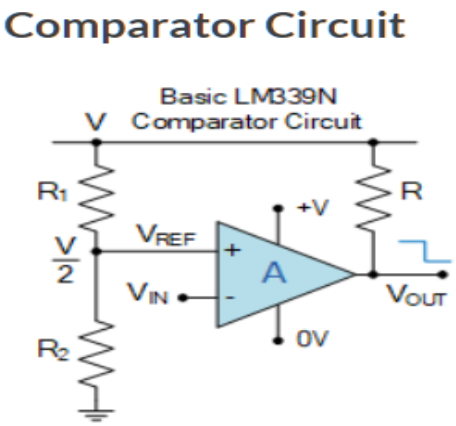
5 Mr. Shyam brought 4 battery cells of rating 3.6 volts, 3400mAh to provide power supply to his smartphone. The battery capacity of the smartphone is 3.6 volt, 13600mAh. He wants to know the configuration (series/parallel) in which the battery cells are connected to provide the above rating to the smartphone. In how many ways the battery cells can be connected and draw a neat diagram to show the connection diagram of battery cells to help Mr. Shyam to get the required rating.

(C.O.No.3) [Comprehension]

Part C [Problem Solving Questions]

Answer the Question. Each question carries NINE marks. (1Qx9M=9M)

6 An LM339 comparator circuit in ADC compares the reference voltage with the input voltage and accordingly it provides the output. In the Fig. 1 shown below, V_{REF} is obtained from the voltage



divider network setup by R_1 and R_2. If the two resistors are of equal values, that is R_1 = R_2, then clearly the reference voltage level will be equal to half the supply voltage, or V/2.

Fig. 1. Comparator circuit in ADC

a) If the resistors R_1=20 ohms and R_2=30 ohms , then what will be the value of V_{REF}. Consider V = 50 volts. [6M]

b) Which ADC architecture employs this type of method to sense the voltage in BMS?

(C.O.No.3) [Comprehension]

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SCHOOL OF ENGINEERING

END TERM EXAMINATION

Winter Semester: 2021 - 22
Course Code: EEE3036
Course Name: Battery Management Systems
Program & Sem: B.Tech & IV Sem

Date: 6th July 2022
Time: 09:30 AM to 12:30 PM
Max Marks: 100
Weightage: 50 %

Instructions:
(iii) Read the all questions carefully and answer accordingly.
(iv) All of you should bring your calculator

Part A [Memory Recall Questions]

Answer all the Questions. Each question carries TEN marks. (4Qx 10M= 40M)

Q.NO.1 Describe State of Charge, State of Health, C-Rate, and DoD in the battery management system. (C.O.No.1) [Knowledge]
Q.NO.2 State in detail four methods to estimate SoC. (C.O.No.1) [Knowledge]
Q.NO.3 Describe the factors affecting capacity Estimation? (C.O.No.2) [Knowledge]
Q.NO.4 Identify the need of sensing the isolation in the battery management system. (C.O.No.3) [Knowledge]

Part B [Thought Provoking Questions]

Answer both the Questions. Each question carries FIFTEEN marks. (2Qx15M=30M)

Q.NO.5 Mahesh disconnected his electric vehicle battery while going on vacation. After some days, he arrived and wants to reconnect the battery installed in his electric vehicle. State the procedures to connect the terminals of the battery safely to the electric vehicle with a neat and clean diagram. (C.O.No.3) [Comprehension]
Q.NO.6 Mr. Piyush wants to apply serial bus communication to save copper wires in Electric Vehicle. Suggest any standard architecture with neat and clean diagram to send the data sequentially to communicate with other devices in BMS. (C.O.No.4) [Application]

Part C [Problem Solving Questions]

Answer the Question. The question carries THIRTY marks. (1Qx30M=30M)

Q.NO.7 A 15 volts battery capacity of 600 Ah that is theoretically at 80 % SoC and depth of discharge of 50 %.

(i) Find the charge stored. [10M]
(ii) Find the energy delivered to the load. [10M]

(iii) How much would be the charge stored by the battery if the battery capacity is reduced to 400 Ah and find the net reduction in charge? [10M]

(C.O.No.3) [Comprehension]