Name:

Enrolment No:

UPES

End Semester Examination, December 2024

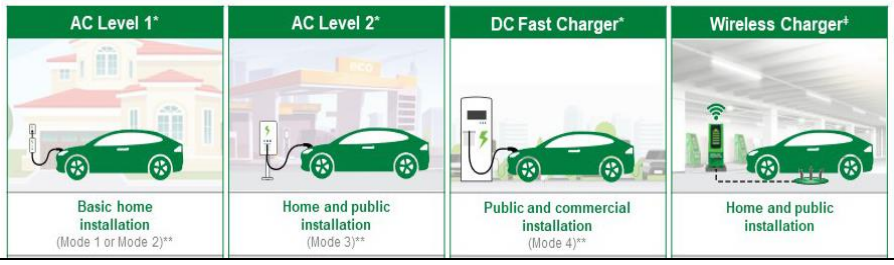
Course: EV Batteries and Charging systems **Semester: VII**

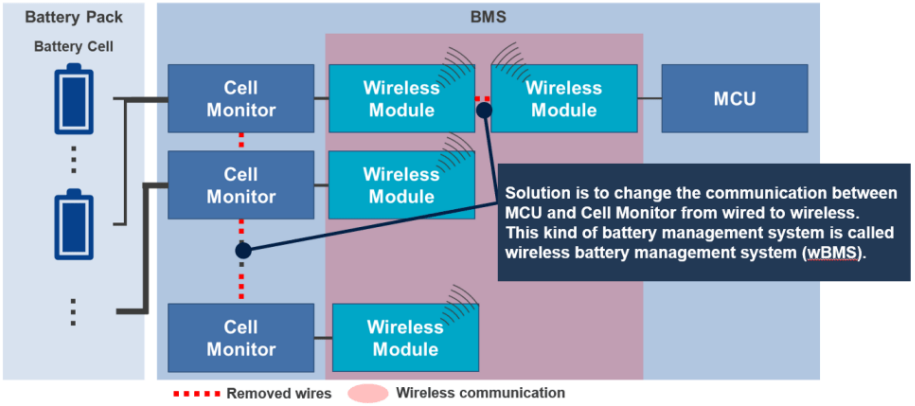
Program: B.Tech EE **Time : 03 hrs.**

Course Code: EPEG4030 **Max. Marks: 100**

Instructions: Read all the questions carefully. You can do it. All the best!

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	What is passive cell balancing. Describe briefly with neat sketches.	**4**	**CO1**
Q 2	Describe basic EV AC and DC Chargers.	**4**	**CO2**
Q 3	Explain the working principle of a lithium-ion cell with the help of equations and neat sketch.	**4**	**CO2**
Q 4	Compare the advantages and challenges of battery swapping technology.	**4**	**CO1**
Q 5	Explain the key functionalities of BMS.	**4**	**CO2**
	SECTION B **(4Qx10M= 40 Marks)**		
Q 6	What are the different charging methods used in EV? Elaborate on standards adopted for same worldwide.	**10**	**CO3**
Q 7	Calculate the electrical power needed for a charging station which needs to have 2 numbers of 15 kW GB/T, 10 numbers of AC001 and 1 number of 30 kW CCS2 chargers. We know that AC001 has a maximum rated power of 10 kW.	**10**	**CO3**
Q 8	Write down the expected voltage rating, current rating and charging time for following charging systems. 	**10**	**CO3**

Q 9	Draw the Thevenin equivalent circuit model of a cell and use Kirchhoff's law to write down the circuit expressions.	**10**	**CO3**
	SECTION-C **(2Qx20M=40 Marks)**		
Q 10	Explain the working principle of an EV battery charging alternator with the help of suitable diagrams. A 3φ, 60Hz, 15HP,460V, 4 pole, 1728rpm induction machine of EV delivers full output power to a load connected to its shaft. The windage and friction loss of the motor is 750W. Determine (i) mechanical power developed (ii) air-gap power (iii) rotor copper loss. OR A battery management system like the one below is called a Wireless Battery Management System (wBMS). Explain the functions of each block in detail.  	**20**	**CO4**
Q 11	To enable the battery pack to be put into use in the microgrid, it is not enough to estimate the pack SoC simply. More functions of the battery pack must be implemented, such as state of health (SoH) estimation, state of power (SoP) estimation, and state of energy (SoE) estimation. In addition, more factors need to be considered, like working temperature, battery cycle life, etc. Design a microgrid enabled with battery pack and indicate process and directives of operation.	**20**	**CO4**