DEPARTMENT OF ELECTRICAL ENGINEERING

DELHI TECHNOLOGICAL UNIVERSITY

GOVERNMENT OF NCT OF DELHI

SHAHBAD DAULATPUR, BAWANA ROAD, DELHI-110042

Chargers and Charging Infrastructure (EV355)

ASSIGNMENT NO 1

Last Date of Submission: November 16, 2024

Course Outcomes (CO's): Students will be able to

CO1	understand the different types of Electric Vehicles (EVs) such as Battery EVs, Hybrid EVs, Fuelled EVs, Solar-Powered EVs and associated technologies.
CO2	gain a detailed understanding of various energy storage systems and also able to evaluate key parameters such as battery sizing, charging/discharging cycles, and energy storage modelling for different types of EVs.
CO3	to analyse and design EV charging infrastructure, including the differences between slow and fast chargers, the necessary design ratings for chargers, and the standards used.
CO4	design and analyse the basic requirements of a charging system, the selection of appropriate power components (e.g., Boost PFC, Boost inductor sizing), and loss calculation in chargers.
CO5	select and specify the appropriate AC (Type-1, Type-2, Type-3) and DC chargers based on type of vehicle, battery pack, and infrastructure availability.

Q1. An electric vehicle has a battery capacity of 60 kWh and consumes energy at a rate of 0.2 kWh/mile. How far can the vehicle travel on a full charge? [CO2]

Q2. A Level 2 AC charger outputs 7.2 kW. If an EV with a 40 kWh battery is at 20% charge, how long will it take to fully charge the battery? [CO2]

Q3. If an electric vehicle consumes 15 kWh for a distance of 100 miles, what is the vehicle's range with a 75 kWh battery? [CO2]

Q4. An electric vehicle motor has an efficiency of 90%. If the vehicle accelerates from 0 to 60 mph in 6 seconds and the vehicle's weight is 3,000 lbs, calculate the required motor power. [CO3]

Q5. An electric motor operates at an efficiency of 85%. If it delivers 60 kW to the wheels, what is the input power drawn from the battery? [CO2]

Q6. An EV weighing 1,500 kg accelerates from 0 to 100 km/h in 8 seconds. Calculate the average power required during the acceleration phase. [CO3]

Q7. If the cost of electricity is $0.12 per kWh, how much does it cost to charge an EV with a 50 kWh battery from 20% to full? [CO2]

Q8. An EV with regenerative braking can recover 30% of the kinetic energy when slowing down. If it has a speed of 90 km/h (25 m/s) and weighs 1,200 kg, how much energy can be recovered during braking? [CO2]

Q9. If an EV battery has a cycle life of 1,000 cycles and loses 20% capacity over its lifetime, what will be the remaining capacity after 1,000 cycles if its original capacity is 60 kWh? [CO2]

Q10. An EV battery pack generates 1 kW of heat during operation. If the cooling system removes heat at a rate of 800 W, what is the net heat buildup in the battery per hour? [CO2]