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Bengaluru

Mid Term Examinations - October 2026

Date: 06/10/2026 **Time:** 09:30 AM - 11:00 AM

Course Code: EEE3048 **Course Name:** Power Electronics Applications for Electrical Vehi

Semester: Seventh Semester **Max. Marks:** 50 **Weightage:** 50%

CO - Levels	CO1	CO2
Marks	56	34

PART A: Answer Following Questions. 10 M

Q.N.	Questions	M	CO	BT
1	Outline the core components of an EV drivetrain.	2	CO1	BT2
2	Summarize the daily function of an onboard charger.	2	CO1	BT1
3	An EV of mass 1200 kg has a rolling resistance coefficient of 0.01. Calculate its rolling resistance force on a level road. Take $g = 9.81\ m/s^2$.	2	CO1	BT2
4	A vehicle experiences 200 N rolling resistance, 300 N aerodynamic drag and 500 N grade resistance. Calculate the total tractive force if acceleration resistance is neglected	2	CO2	BT1
5	An EV has a wheel radius of 0.30 m and requires 1500 N tractive force. Calculate the required wheel torque.	2	CO2	BT1

PART B : Answer Any 1 Following Questions. 10 M

Q.N.	Questions	M	CO	BT
6	An EV of mass 1500 kg travels at 72 km/h on a level road. The coefficient of rolling resistance is 0.012, $C_d = 0.30$, frontal area $A = 2.2m^2$, and air density is $1.225kg/m^3$. Calculate: 1. Rolling resistance 2. Aerodynamic drag 3. Total tractive force 4. Wheel power	10	CO1	BT3
7	A 1500 kg EV travels at 72 km/h and is brought to rest. If 70% of the kinetic energy can be recovered through regenerative braking, calculate recovered energy.	10	CO1	BT3

PART C: Answer Any 1 Following Questions. 10 M

Q.N.	Questions	M	CO	BT
8	A boost converter increases battery voltage from 250 V to 400 V. Output power is 20 kW and converter efficiency is 94%. Calculate: 1. Duty ratio 2. Input power 3. Battery current	10	CO1	BT2

9	A DC-DC buck converter reduces 400 V battery voltage to 200 V. The output current is 40 A. Assume ideal conversion. Find: 1. Duty ratio 2. Output power 3. Input current	10	CO2	BT3

PART D: Answer Any 1 Following Questions. 10 M				
Q.N.	**Questions**	**M**	**CO**	**BT**
10	A parallel HEV requires 100 kW at the wheels. The engine supplies 60 kW, and the electric motor supplies the remaining power. The motor efficiency is 93%, drivetrain efficiency is 90%, and battery voltage is 350 V. Determine: 1. Mechanical power supplied by the motor 2. Motor electrical input power 3. Battery power requirement 4. Battery current 5. Percentage of wheel power supplied by the motor	10	CO1	BT3
11	An EV consumes 160 Wh/km at the wheels and must achieve a range of 320 km. The overall drivetrain efficiency is 90%, and only 80% of the nominal battery energy is intended to be usable. Determine: 1. Energy required at the wheels 2. Usable battery energy required 3. Minimum nominal battery energy 4. Explain why the nominal battery capacity must be greater than the usable energy requirement.	10	CO2	BT3

PART E: Answer Any 1 Following Questions. 10 M				
Q.N.	**Questions**	**M**	**CO**	**BT**
12	An EV traction motor requires 50 kW mechanical power. The motor efficiency is 94%, inverter efficiency is 96%, and the battery voltage is 400 V. The maximum permissible battery discharge rate is 3C. Determine: 1. Battery power required 2. Battery current 3. Minimum battery capacity in Ah based on the 3C limit	10	CO2	BT4
13	A 1600 kg EV accelerates from rest to 90 km/h in 12 s. Given: $C_{rr} = 0.012$ $C_d = 0.28$ $A = 2.1\ m^2$ $\rho = 1.225\ kg/m^3$ Determine: 1. Acceleration 2. Acceleration force 3. Rolling resistance 4. Aerodynamic drag at final speed 5. Total tractive force 6. Wheel power at final speed	10	CO1	BT3