Module 16: Assignment
Charging Stations and Scripting

Problem Statement:

As a design engineer for electric vehicles (EVs), your task is to analyze the performance of a power supply circuit. This circuit integrates semiconductor devices and transformers crucial for efficient power delivery in EVs. Your objective is to calculate key parameters related to power MOSFETs, Insulated Gate Bipolar Transistors (IGBTs), ideal transformers, and forward converters. These parameters drive optimization efforts to enhance EV power systems' performance and reliability, advancing EV technology.

Tasks to be Performed:

1. Power MOSFET:

Given:
- Gate and drain capacitance = 20 pF
- Gate and source capacitance = 15 pF
- Drain and source capacitance = 10 pF

Calculate the total input capacitance, output capacitance, and reverse transfer capacitance of the power MOSFET.

2. Insulated Gate Bipolar Transistor (IGBT):

Given:
- Collector to emitter voltage = 10 V
- Load resistance = 100 Ω
- Gate to source capacitance = 25 pF
- Rate of change of gate to source voltage = 1 V/ns
` - Collector to emitter voltage = 25 V
- Collector to emitter saturation voltage = 1.8 V

Calculate the collector current, gate current, and forward voltage drop of the IGBT.

3. Ideal Transformer:

Given:
- Primary voltage = 120 V
- Secondary voltage = 12 V

- Primary current = 5 A

Calculate the secondary current of the ideal transformer.

3. Forward Converter:

Given:
- Input voltage = 24 V
- Duty cycle = 0.5
- Number of turns in primary winding = 100
- Number of turns in secondary winding = 10

Calculate the output voltage of the forward converter.