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**CMR COLLEGE OF ENGINEERING & TECHNOLOGY
(UGC AUTONOMOUS)**

Examination : M.Tech I Semester Supplementary Examinations August-2025
Course Name : Machine Modeling and Analysis
Course Code : B443401
Branch : Power Electronics
Date & Session : 26-08-2025 AN **Duration: 3 hours** **Max. Marks: 60**

(Note: Assume suitable data if necessary)

PART-A

**Answer all TEN questions
Each question carries ONE mark.**

10x1=10M

1. Write torque equation of basic two-pole DC machine. 1 M
2. Draw basic primitive 2-axis machine. 1 M
3. What is significance of transformation? 1 M
4. Write expression of linear transformation. 1 M
5. Model (Draw) 2-axis model of 3- phase induction motor. 1 M
6. Recall torque equation of 2-axis model of 3-phase induction motor. 1 M
7. Write voltage equations of 3-ph synchronous motor in stator-reference frame. 1 M
8. Model (Draw) 2-axis model of 3-phase synchronous motor. 1 M
9. List out the applications of Permanent Magnet Synchronous motor. 1 M
10. Recall the advantages of Brushless DC Motor. 1 M

PART-B

Answer the following. Each question carries TEN Marks.

5x10=50M

- 11.A). A separately excited dc motor fed from SCRs has the following data: Total resistance of motor armature & SCR circuit $R=0.05\Omega$; Total inductance of motor armature & SCR circuit, $L = 0.01H$; No load source voltage = 250V; Inertia of rotating parts, $J=18 \text{ kg-m}^2$, Motor torque constant, $K_m = 3 \text{ Nm/armature amperes}$; friction and windage constant, $D=0$. 10M
- i) Find the undamped natural angular frequency and the damping ratio of the motor system.
 - ii) If the motor takes a no-load current of 10A, calculate it's no-load speed.
 - iii) For a sudden applied torque of 1000 Nm on the motor shaft, calculate the ultimate speed drop.

OR

11. B). Examine the expression for developed torque in a dc series motor. 10M
12. A). In order to ensure power invariance in transforming one set of variables to another, show that the transformation matrix should be equal to its inverse. 10M

OR

12. B). Explain the importance of phase and active transformations in case of AC motors. 10M

(P.T.O.)

13. A). Solve voltage and current equations of a 3- ϕ induction motor with synchronously rotating reference frame. 10M

OR

13. B). Derive torque equation of 3-ph Induction Motor. 10M

14. A). Derive the expressions for armature mutual inductances of a salient pole synchronous machine from a consideration of its basic parameters. 10M

OR

14. B). Model and explain the generalized diagram of a 3-phase synchronous motor with field and damper windings on the rotor. 10M

15. A). Examine voltage and current equations of 2-axis model of permanent magnet Synchronous motor and explain. 10M

OR

15. B). Model 2-axis model of Brushless DC motor and explain. 10M

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CMR COLLEGE OF ENGINEERING & TECHNOLOGY
(UGC AUTONOMOUS)

Examination : M.Tech I Semester Supplementary Examinations Aug/Sept-2025
Course Name : Advanced Power Electronic Converters-I
Course Code : B443301
Branch : Power Electronics
Date & Session : 01-09-2025 AN **Duration: 3 hours** **Max. Marks: 60**

(Note: Assume suitable data if necessary)

PART-A

Answer all TEN questions
Each question carries ONE mark.

10x1=10M

1. Define the term "Switching loss" in power devices. 1 M
2. Mention two applications of power MOSFETs. 1 M
3. Distinguish between half-controlled and fully-controlled converters. 1 M
4. What is the effect of source inductance on converter performance? 1 M
5. Why is high-frequency switching used in PWM inverters? 1 M
6. What are the applications of PWM inverters? 1 M
7. What is the difference between 120° and 180° conduction mode in inverters? 1 M
8. What is the function of a PWM controller in a three-phase inverter? 1 M
9. What is a cascaded H-bridge inverter? 1 M
10. Mention one difference between NPC and flying capacitor inverters. 1 M

PART-B

Answer the following. Each question carries TEN Marks.

5x10=50M

- 11.A). Explain the construction, working, and characteristics of the following modern power semiconductor devices: 10M
- i) Power MOSFET
 - ii) IGBT (Insulated Gate Bipolar Transistor)
 - iii) GTO (Gate Turn-Off Thyristor)

OR

11. B). Explain the role of modern semiconductor devices in renewable energy systems and electric vehicles. 10M
12. A). Explain the effect of source inductance on the performance of a single-phase converter. How is commutation overlap angle affected? 10M

OR

12. B). Explain the working of a three-phase fully-controlled bridge converter with waveforms and mathematical analysis. 10M
13. A). Derive the expression for output voltage in sinusoidal PWM technique and explain how modulation index affects the output. 10M

OR

13. B). Discuss the role of PWM in voltage and frequency control in induction motor drives. 10M

(P.T.O.)

14. A). Describe the construction and operation of a three-phase PWM inverter. Explain how SPWM or SVPWM is implemented. 10M

OR

14. B). Derive the line and phase voltage equations for a 3-phase inverter operating in 180° conduction mod. 10M

15. A). Discuss the harmonic reduction in multilevel inverters. How does increasing the number of levels affect THD? 10M

OR

15. B). Describe the control strategies used in multilevel inverters, such as: 10M

- i) Sinusoidal PWM
- ii) Space Vector PWM (SVPWM)
- iii) Selective Harmonic Elimination (SHE).

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**CMR COLLEGE OF ENGINEERING & TECHNOLOGY
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Examination : M.Tech I Semester Supplementary Examinations Aug/Sept-2025
Course Name : Electric Vehicles and Design
Course Code : B443408
Branch : Power Electronics
Date & Session : 09-09-2025 AN **Duration:** 3 hours **Max. Marks:** 60

(Note: Assume suitable data if necessary)

PART-A

**Answer all TEN questions
Each question carries ONE mark.**

10x1=10M

1. Define rolling resistance. 1 M
2. What are the issues involved in conventional vehicle? 1 M
3. Define hybrid vehicle. 1 M
4. Draw the block diagram of hybrid electric drive train. 1 M
5. What is the purpose of the electric propulsion system? 1 M
6. Mention the components in energy source sub system. 1 M
7. List out the requirements for energy storage in hybrid electric vehicles. 1 M
8. What are factors involved in the size of the drive system? 1 M
9. List out the issues involved in energy management. 1 M
10. Mention types of energy management strategies. 1 M

PART-B

Answer the following. Each question carries TEN Marks.

5x10=50M

- 11.A). Explain in detail vehicle transmission characteristics. 10M
- OR**
11. B). What is mathematical model? How to represent to vehicle performance in mathematical model? 10M
12. A). What are various types of hybrid drive trains topologies and explain the series configuration of hybrid drive train topology? 10M
- OR**
12. B). Analyze the social and environmental importance of hybrid and electric vehicles. 10M
13. A). Briefly explain the control and configuration of permanent magnet motor drives in electric vehicles. 10M
- OR**
13. B). Detail the configuration and control of induction motor drives in electric vehicle. 10M
14. A). Analyze the flywheel-based energy storage in electric vehicle. 10M
- OR**
14. B). Define sizing and how to sizing the power electronics for electric vehicle. 10M
15. A). Discuss in detail the design of hybrid electric vehicle (HEV). 10M
- OR**
15. B). Compare the different types of energy management strategies of electric vehicle. 10M
