MAHATMA GANDHI INSTITUTE OF TECHNOLOGY
(Autonomous)
M.Tech. I Semester End Examinations
(Model Question Paper)

MR-22

Course Title: Advanced Power Electronic Converters-I **Course Code: EE101PC**
Time: 3 hours Max. Marks : 60

Note: Answer ALL Questions
Part-A (10 x 1 = 10 Marks)

Q. No.	Stem of the Question	M	L	CO	PO
	Unit-I				
1. a)	What are the applications of IGCT?	1	2	1	1, 2
1. b)	What are the advantages of ETO?	1	2	1	1, 2
	Unit-II				
1. c)	What are the applications of Dual Converters?	1	1	2	1, 2
1. d)	What are the effects of source inductance on phase controlled converters	1	3	2	1, 2
	Unit-III				
1. e)	Define Total Harmonic Distortion.	1	2	3	1, 2
1. f)	What are the advantages of Pulse width modulated Inverters?	1	2	3	1, 2
	Unit-IV				
1. g)	What are the effects of harmonics?	1	2	4	1, 2
1. h)	List out the modulation techniques used for three phase Inverters.	1	1	4	1, 2
	Unit-V				
1. i)	What are the advantages of multilevel inverters?	1	1	5	1, 2
1. j)	What are the applications of Multilevel Inverters?	1	3	5	1, 2

Part-B (5 x 10=50 Marks)

Q. No.	Stem of the Question	M	L	CO	PO
	Unit-I				
2. a)	Explain the operation of MTO.	7	2	1	1, 2
2. b)	What are the advantages of MTO?	3	2	1	1, 2
	OR				
2. c)	Compare GTO with SCR.	5	2	1	1, 2
2. d)	What are the advantages and disadvantages of GTO.	5	2	1	1, 2
	Unit-II				
3. a)	Explain the power factor improvement techniques of single phase controlled converter.	6	4	2	1,2,3
3. b)	Explain the operation of series converter.	4	2	2	1, 2
	OR				
3. c)	Three phase fully controlled converter has a load of L=1.5mH, R= 2.5Ω and E= 10V. The line-to-line input voltage is V_{ab} =208V(rms), 60 Hz. The delay angle is $\alpha = \pi/3$. Determine (a) the steady-state load current I_{L1} at $\omega t' = \pi/3 + \alpha$ (or $\omega t = \pi/6 + \alpha$), (b) the average thyristor current I_{TAV} (c) the rms thyristor current I_{TR} (d) the rms output current I_{OR} (e)the average output current I_{dc}	6	4	2	1,2,3
3. d)	What is a twelve pulse converter? What are its applications?	4	2	2	1, 2
	Unit-III				
4. a)	Explain the operation of single phase Bridge Inverter with R, L , C loads with waveforms	7	2	3	1, 2
4. b)	Explain the Harmonic Injection modulation technique.	3	2	3	1, 2

OR					
4. c)	The single phase full bridge inverter has a resistive load of R= 2.4Ω and the dc input voltage is V_s= 48V. Determine (a)the rms output voltage at the fundamental frequency V_{o1}, (b) the output power P_o, (c) the average and peak currents of each transistor, (d) the peak reverse blocking voltage V_{BR} of each transistor.	6	4	3	1,2,3
4. d)	Explain the various performance parameters that evaluate Inverters.	4	2	3	1, 2
Unit-IV					
5. a)	Explain the operation of three phase Inverters with 180 degree conduction with waveforms.	6	2	4	1, 2
5. b)	Compare 180 degree and 120 degree conduction modes of operation.	4	2	4	1, 2
OR					
5. c)	Explain Space Vector Modulation.	7	5	4	1,2,3
5. d)	Explain third harmonic Pulse width modulation technique.	3	2	4	1, 2
Unit-V					
6. a)	Explain the principle of operation and features of Flying capacitors Multilevel Inverter.	7	4	5	1, 2
6. b)	Describe how multilevel inverters are used for reactive power compensation.	3	4	5	1, 2
OR					
6. c)	What are the features of Diode-Clamped Multi-level Inverter? Explain its operation.	7	3	5	1, 2
6. d)	Write about DC link capacitor voltage balancing.	3	2	5	1, 2

M: Marks; L: Bloom's Taxonomy Level; CO: Course Outcome; PO: Programme Outcome

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MR-22

Course Title: Machine Modeling and Analysis **Course Code:EE102PC**
Time: 3 hours Max. Marks : 60

Note: Answer ALL Questions
Part-A (10 x 1 = 10 Marks)

Q. No.	Stem of the Question	M	L	CO	PO
	Unit-I				
1. a)	Draw the basic two pole machine representation of an Amplidyne?	1	1	1	1
1. b)	What is a Psuedo-stationary coil?	1	1	1	1
	Unit-II				
1. c)	Draw the d-q equivalent of one set of displaced brushes?	1	1	2	1
1. d)	Write the transformation matrix from three phases (a,b,c) to two phases (α,β,o)?	1	2	2	2
	Unit-III				
1. e)	What are the assumptions to derive the dynamic model of an Induction Machine?	1	1	3	1
1. f)	What are the advantages of arbitrary reference frames?	1	1	3	1
	Unit-IV				
1. g)	Draw the three phase circuit model representation of a three phase Synchronous Motor?	1	1	4	1
1. h)	What is the dynamic model representation of a three phase Synchronous Motor?	1	1	4	1
	Unit-V				
1. i)	What is quadrature axis inductance?	1	1	5	1
1. j)	What are the truth tables in the modeling of a Permanent Magnet Synchronous Machine?	1	1	5	1

Part-B (5 x 10=50 Marks)

Q. No.	Stem of the Question	M	L	CO	PO
	Unit-I				
2. a)	Starting from fundamentals, illustrate the mathematical model for a DC Compound Motor and express the relevant equations?	5	2	1	1
2. b)	Relate a DC Series Motor with respect to generalized machine theory?	5	2	1	2
	OR				
2. c)	Explain in detail about the coupling between armature and field in DC machines?	5	2	1	1
2. d)	Interpret the direct and quadrature axis components of a DC machine?	5	2	1	1
	Unit-II				
3. a)	Derive the transformation from three phases (a,b,c) to two phases(α,β,o) analyzing how the MMFs of three phase and two phase systems can be equalized?	5	4	2	3
3. b)	Prove that power invariance is maintained for transformation from three phases (a,b,c) to two phases(α,β,o)?	5	5	2	3
	OR				
3. c)	Explain the various transformation techniques in electrical machines?	5	2	2	1
3. d)	Discuss in detail about the procedural differences between phase and linear transformations?	5	6	2	1
	Unit-III				
4. a)	Analyze the generalized model of a three phase Induction Motor in Rotor Reference Frames model by deriving necessary equations?	5	4	3	2
4. b)	Analyze the torque equation in rotor reference frame for AC machines and explain various factors that determine the torque?	5	2	3	2
	OR				

4. c)	Illustrate the equivalent circuit of a Three phase Induction Motor?	5	2	3	2
4. d)	Write the torque equation in synchronously rotating reference frame for AC machines and explain various factors that determine the torque?	5	1	3	1
Unit-IV					
5. a)	Derive and analyze the expressions for self and mutual inductances of stator of a three phase Synchronous Motor?	5	4	4	3
5. b)	Derive the expression for electromagnetic torque in a three phase Synchronous Motor?	5	4	4	3
OR					
5. c)	Explain the two axis model of the Synchronous Motor?	5	2	4	2
5. d)	Derive and analyze the expressions for self and mutual inductances of rotor of a three phase Synchronous Motor?	5	4	4	3
Unit-V					
6. a)	Derive the necessary equations in the modeling of a Permanent Magnet Synchronous Machine?	5	4	5	3
6. b)	Explain the classification of Permanent Magnet Synchronous Machines?	5	2	5	1
OR					
6. c)	Derive the necessary equations in the modeling of a Permanent Magnet Brush less DC Motor?	5	4	5	3
6. d)	Explain the operating principle of a Permanent Magnet Synchronous Machine?	5	2	5	1

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MR-22

Course Title: HVDC Transmission **Course Code: EE111PE**
Time: 3 hours Max. Marks : 60

Note: Answer ALL Questions
Part-A (10 x 1 = 10 Marks)

Q. No.	Stem of the Question	M	L	CO	PO
	Unit-I				
1. a)	Illustrate the assumptions of Gratez circuit in converter.	1	2	2	2
1. b)	What are the disadvantages of HVAC system?	1	1	1	1
	Unit-II				
1. c)	Explain VA rating of valve.	1	2	2	3
1. d)	Examine and draw the equivalent characteristics of Inverter used in HVDC transmission.	1	4	2	3
	Unit-III				
1. e)	What is meant by Firing angle control?	1	1	3	2
1. f)	Develop the converter control characteristics.	1	3	3	4
	Unit-IV				
1. g)	Examine Arc back and causes of arc back.	1	3	4	1
1. h)	What do you understand by commutation failure?	1	1	4	1
	Unit-V				
1. i)	Define reactive power control.	1	1	5	5
1. j)	Explain a short note on harmonics in HVDC system.	1	2	5	2

Part-B (5 x 10=50 Marks)

Q. No.	Stem of the Question	M	L	CO	PO
	Unit-I				
2. a)	What are the different types of DC links? Explain.	5	1	2	1
2. b)	Distinguish HVDC and HVAC systems.	5	4	1	2
	OR				
2. c)	Explain the technological development of modern trends in DC transmission.	5	2	1	5
2. d)	What are the parameters defining the choice of best circuit for HVDC converters?	5	1	2	2
	Unit-II				
3. a)	Analyze a six-pulse Gratez circuit with an overlap angle less than 60 degree for rectifier operation	5	4	2	4
3. b)	What are the required features of rectification circuits for HVDC transmission?	5	1	2	3
	OR				
3. c)	Develop an expression for input power, output power and power factor of 12-pulse bridge converter with delay angle α. Assume there is no overlap.	5	3	1	3
3. d)	Solve a 6-pulse bridge connected inverter, fed from 238/110kv transformer which is connected with 3-φ, 238kv, 50Hz supply. Calculate the direct voltage output when the commutation angle is 20 degree and delay angle α is (i) 30 degree(ii) 150 degree.	5	6	2	2
	Unit-III				
4. a)	Explain with the help of control characteristics how the constant current control and constant extinction angle are used to maintain the	5	2	3	4

	constant power flow in the HVDC link.				
4. b)	Define overlap angle and extinction angle.	5	1	3	2
OR					
4. c)	Explain in detail about the transformer tap changer with its types.	5	2	3	5
4. d)	Discuss in detail about principle of DC link control.	5	6	3	2
Unit-IV					
5. a)	Explain starting and stopping of DC link	5	2	4	6
5. b)	Classify different types of protections in converter against overcurrent?	5	3	4	6
OR					
5. c)	Explain briefly the disturbances originating on AC and DC side	5	2	4	1
5. d)	Classify different types of protections in converter against overvoltage?	5	3	4	2
Unit-V					
6. a)	Classify the solution methodology for AC-DC load flows and explain.	5	4	5	6
6. b)	Explain how transient stability is improved with the help of series controllers.	5	2	4	3
OR					
6. c)	Illustrate in brief about AC and DC filters used in HVDC system.	5	2	5	3
6. d)	How to prevent voltage instability using static shunt compensation.	5	1	5	2

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Course Title: Hybrid Electric Vehicles and Design **Course Code: EE118PE**
Time: 3 hours Max. Marks: 60

Note: Answer ALL Questions
Part-A (10 x 1 = 10 Marks)

Q. No.	Stem of the Question	M	L	CO	PO
	Unit-I				
1. a)	Define Gradeability?	1	3	1	1
1. b)	Write a short notes on conventional vehicle?	1	2	1	1
	Unit-II				
1. c)	Give the two typical speed coupling devices?	1	2	1	1
1.d)	Define fuel efficiency?	1	1	1	1
	Unit-III				
1. e)	What is the purpose of power converter in Electric Propulsion System?	1	2	1	2
1.f)	Give the applications of step-Up chopper?	1	2	1	2
	Unit-IV				
1. g)	Give the chemical equations of a battery during charging and discharging?	1	2	2	2
1.h)	Define the following terms related to batteries i) Thermodynamic Voltage and ii) Specific Power	1	1	2	2
	Unit-V				
1. i)	Classify the Energy Management Strategies?	1	1	3	3
1.j)	Mention the advantages of fuzzy logic over conventional rule-based control methods of Energy Management Strategy?	1	2	3	2

Part-B (5 x 10=50 Marks)

Q. No.	Stem of the Question	M	L	CO	PO
	Unit-I				
2.a)	Explain the historical development of Electric Vehicle?	5	1	1	1
2.b)	Explain the impact of modern drive-trains on energy supplies?	5	2	1	2
	OR				
2. c)	Describe the dynamic equation of the vehicle?	5	3	1	3
2.d)	Explain the transmission characteristics of a vehicle?	5	2	1	2
	Unit-II				
3. a)	Discuss briefly the basic concept of hybrid traction?	5	2	1	1
3. b)	Explain the various operating modes in series hybrid electric drive train?	.5	2	1	2
	OR				
3. c)	Explain the hybrid drive train with speed coupling of planetary gear unit?	5	2	1	2
3.d)	Explain the torque-coupling parallel hybrid electric drive train?	5	2	1	2
	Unit-III				
4. a)	With neat sketches, explain the class A chopper control of DC motor?	6	3	1	3
4. b)	Explain the combined armature voltage and field control of DC motor?	4	2	1	2
	OR				
4. c)	Explain the functional block diagram of a typical electric propulsion system?	5	4	1	3
4.d)	Explain the multiquadrant control of Class C chopper with neat	5	3	1	3

	sketches and wave forms?				
Unit-IV					
5. a)	Explain the hybridization of different energy storage devices?	6	2	2	2
5. b)	Write short notes on matching of electric drive and ICE?	4	1	1	2
OR					
5. c)	What is the principle involved in ultra capacitor and explain the mechanism of energy storage?	6	2	2	2
5.d)	Discuss briefly the operating principle of flywheels?	4	1	2	1
Unit-V					
6. a)	Explain the basic principle of rule-based control methods of Energy Management Strategy?	5	3	3	2
6. b)	Design a Battery Electric Vehicle?	5	5	2	1
OR					
6. c)	Design a Hybrid Electric Vehicle?	5	5	2	2
6.d)	Compare the different management strategies?	5	3	3	3

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