Reg. No.															

B.Tech. DEGREE EXAMINATION, DECEMBER 2023

Sixth Semester

18MHC204T – POWER ELECTRONICS AND DRIVES

(For the candidates admitted from the academic year 2020-2021 & 2021-2022)

Note:

(i) **Part - A** should be answered in OMR sheet within first 40 minutes and OMR sheet should be handed over to hall invigilator at the end of 40th minute.

(ii) **Part - B & Part - C** should be answered in answer booklet.

Time: 3 hours | Max. Marks: 100

PART – A (20 × 1 = 20 Marks)

Answer **ALL** Questions

	Marks	BL	CO	PO

1. Schottky diodes are characterized by very _____ recovery time and _____ forward voltage drop. — 1 | 2 | 1 | 1
   (A) Fast, high (B) Fast, low
   (C) Slow, high (D) slow, low

2. The I_{RM} is defined as _____ and its expressed by — 1 | 2 | 1 | 1
   (A) Peak inverse current, $2Q_R / t_{rr}$ (B) Reverse peak current, $\sqrt{2}(Q_R / t_{rr})$
   (C) Reverse peak current $2/3Q_R * t_{rr}$ (D) Peak inverse current, $\sqrt{2}(Q_R)/3 * t_{rr}$

3. In a fast recovery diode, the recovery time will — 1 | 2 | 1 | 1
   (A) As low as 50 ns (B) As low as 150 ns
   (C) As low as 50 ms (D) Ranging between 100 to 200 ms

4. The value of anode current required to maintain the conduction of an SCR even though the gate signal is removed is called as the _____ current. — 1 | 1 | 1 | 1
   (A) Holding (B) Latching
   (C) Switching (D) Peak anode

5. The self-commutated device which are used in chopper circuits are — 1 | 1 | 2 | 1
   (A) Thyristor (B) Diode
   (C) Power MOSFET (D) GTO

6. A single phase fully controlled rectifier operates in _____ quadrants. — 1 | 2 | 2 | 1
   (A) I and II (B) II and III
   (C) I and IV (D) II and IV

7. The average output voltage is maximum when SCR is triggered at w_t=____. — 1 | 2 | 2 | 1
   (A) π (B) 0
   (C) π/2 (D) π/4

8. Which of the following chopper operates in four quadrants. 1 1 2 1
   (A) Class B chopper (B) Class C chopper
   (C) Class D chopper (D) Class E chopper

9. A three – phase bridge inverter requires minimum of _____ switching devices. 1 2 3 1
   (A) 3 (B) 4
   (C) 6 (D) 8

10. A voltage source inverter has a stiff 1 1 3 1
   (A) DC current at its input (B) DC voltage at its input
   (C) AC current at tis output (D) AC voltage at its output

11. The quality of output ac voltage of a cycloconverter is improved with _____ in output voltage at _____ frequency. 1 1 3 1
   (A) Increase, reduced (B) Increase, increased
   (C) Decrease, reduced (D) Decrease, increased

12. An ac voltage controller converts 1 1 3 1
   (A) Fixed AC to variable DC (B) Fixed DC to variable AC
   (C) Variable AC to fixed AC (D) Variable DC to fixed DC

13. Duty ratio in motoring mode with respect to chopper control is 1 2 4 1
   (A) $\delta = \frac{t_{on}}{T}$ (B) $\delta = \frac{t}{T_{on}}$
   (C) $\delta = t_{on} + \frac{t_{off}}{T}$ (D) $\delta = \frac{t_{on}}{T} + t_{off}$

14. In a multi quadrant chopper drive operation with reverse regeneration, voltage is _____ and current is _____. 1 2 4 1
   (A) Negative, positive (B) Negative, negative
   (C) Positive, negative (D) Positive, negative

15. In a half controlled converter fed DC drive braking obtained is 1 1 4 1
   (A) Plugging (B) Dynamic braking
   (C) Regenerative (D) Shunt excited

16. In a closed loop speed control drive the motor can be operated at 1 1 4 1
   (A) Constant torque (B) Constant speed
   (C) Constant speed and torque (D) Variable speed and torque

17. A 3-phase 440V, 50Hz induction motor has 4% slip. The frequency of rotor current will be 1 2 5 2
   (A) 50 Hz (B) 25 Hz
   (C) 5 Hz (D) 2 Hz

18. What type of motor is applicable for rotor resistance control? 1 1 5 2
   (A) Squirrel cage induction motor (B) Slip ring induction motor
   (C) Both squirrel cage and slip ring induction motor (D) Shaded pole induction motor

19.	What is meant by slip power? (A) Slip power = S P_{ag} (B) Slip power = (S –1) P_{ag} (C) Slip power = (1 – S) P_{ag} (D) Slip power = $(S - 1)^2 P_{ag}$	1	2	5	2
20.	If the field of a synchronous motor is under excited, the power factor will be (A) Lagging (B) Leading (C) Unity (D) More than unity	1	1	5	1

PART – B (5 × 4 = 20 Marks)
Answer **ANY FIVE** Questions

		Marks	BL	CO	PO
21.	Sketch the structure of power MOSFET neatly.	4	3	1	1
22.	A single-phase half-wave controlled rectifier has a purely resistive load R and delay angle is $\alpha=\pi/2$. Find the rectification efficiency.	4	5	2	2
23.	Write short notes on methods of control of chopper.	4	3	3	2
24.	Draw the circuit diagram of line-controlled delta connected 3ϕ ac voltage controller.	4	3	4	2
25.	List out the applications of ac voltage controllers.	4	3	3	2
26.	Sketch the constant torque and constant power operation of a DC motor drive.	4	3	4	2
27.	Explain the operation of stator voltage control.	4	3	5	1

PART – C (5 × 12 = 60 Marks)
Answer **ALL** Questions

		Marks	BL	CO	PO
28. a.	Sketch the structure of IGBT neatly. Also enumerate the functionality of a IGBT with its basic structure and the switching characteristics of IGBT with necessary diagrams. Illustrate the equivalent of IGBT and relate how it's a combination of power semiconductor devices and name them clearly schematically. List out the applications.	12	4	1	1
	(OR)				
b.i.	Elaborate about SOA in a power BJT.	3	2	1	1
ii.	Draw the resistance and resistance capacitance firing circuit for thyristors. Elaborate RC firing circuit operation with relevant waveforms.	9	4	1	1
29. a.	Explain the principle and operation of class type B, C and D chopper.	12	3	2	2
	(OR)				
b.	Explain the circuit diagram and waveforms of single-phase full wave rectifier with RL load.	12	4	2	2

30. a.	Analyse and elaborate the switching sequence of thyristor operating with 120° mode in a voltage source inverter (VSI). Sketch the equivalent circuit for any three steps of operation and draw the line to line and phase voltage obtained by operating the circuit.	12	5	3	2
	(OR)				
b.	Illustrate the switching operation of thyristors in a bridge type step up cycloconverter. Sketch the circuit diagram and waveforms for output frequency being 4 times the input frequency with relevant explanations in the waveform.	12	4	3	2
31. a.	Illustrate the operation of closed loop control of dc drives with neat diagrams.	12	3	4	2
	(OR)				
b.	Elaborate the operation of two quadrant (motoring and braking) operation in a chopper-controlled DC drive with relevant circuit diagrams and sketches.	12	4	5	2
32. a.	How the speed is controlled to avoid slip power loss in induction motor and explain the two types in detail.	12	4	5	2
	(OR)				
b.	Explain the voltage source fed synchronous motor drive using PWM.	12	3	5	2

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