

28. a. Explain the operation of three phase controlled rectifier with relevant waveforms. 10 3 3 3

(OR)

b. Compare single phase half wave and full wave rectifier with the help of circuit and output waveforms. 10 4 3 3

29. a. Compare with the help of output waveforms between 120° and 180° mode of operation. 10 2 4 4

(OR)

b. What is multilevel inverter? Explain the cascaded H bridge type. 10 4 4 4

30. a. What are different types of DC motors used for traction applications? Explain the types of field arrangements with diagram. 10 3 5 5

(OR)

b. Explain the working principle of PMSM. 10 4 5 5

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Reg. No.

**B.Tech. DEGREE EXAMINATION, MAY 2022**  
Sixth Semester

**18AUE411T – POWER ELECTRONICS FOR ELECTRIC VEHICLE APPLICATION**  
(For the candidates admitted from the academic year 2018-2019 to 2019-2020)

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 40<sup>th</sup> minute.  
(ii) **Part - B** should be answered in answer booklet.

Time: 2½ Hours

Max. Marks: 75

**PART – A (25 × 1 = 25 Marks)**

Answer **ALL** Questions

- |   | Marks | BL | CO | PO |
|---|-------|----|----|----|
| 1. The three terminals of the IGBT are<br>(A) Base, emitter and collector (B) Gate, source and drain<br>(C) Gate, emitter and collector (D) Base, source and drain                      | 1     | 1  | 1  | 1  |
| 2. The controlling parameter of IGBT is the<br>(A) $I_C$ (B) $V_{CE}$<br>(C) $I_g$ (D) $V_{GE}$   | 1     | 1  | 1  | 1  |
| 3. _____ based inverters do not require self-commutation.<br>(A) IGBT (B) GTO<br>(C) PMOSFET (D) SCR  | 1     | 1  | 1  | 1  |
| 4. The MOSFET combines the areas of _____ and _____.<br>(A) Field effect and MOS technology (B) Semiconductor and TTL<br>(C) MOS technology, CMOS (D) None of the above technology      | 1     | 1  | 1  | 1  |
| 5. The heat generated in high power semiconductor equipment are in range of<br>(A) 200 Wcm <sup>-2</sup> (B) 2000 Wcm <sup>-2</sup><br>(C) 20 Wcm <sup>-2</sup> (D) 2 Wcm <sup>-2</sup> | 1     | 1  | 1  | 1  |
| 6. A chopper may be thought as a<br>(A) Inverter with DC input (B) DC equivalent of an AC transformer<br>(C) Diode rectifier (D) DC equivalent of an induction motor                    | 1     | 1  | 2  | 2  |
| 7. In a step down chopper, if $V_s=100V$ and the chopper is operated at a duty cycle of 75%. Find the output voltage.<br>(A) 100V (B) 75V<br>(C) 25V (D) 50V                            | 1     | 1  | 2  | 2  |

8. A step down chopper is also called as a 1 1 2 2  
 (A) First quadrant chopper (B) Second quadrant chopper  
 (C) Third quadrant chopper (D) Fourth quadrant chopper
9. In case of variable frequency system \_\_\_\_\_ is varied. 1 1 2 2  
 (A) T (B)  $T_{on}$   
 (C)  $T_{off}$  (D)  $f$
10. What is the expression for load voltage when the chopper is operated in the second quadrant? 1 1 2 2  
 (A)  $V_s$  (B)  $E$   
 (C) 0 (Zero) (D)  $E + L \cdot \frac{di}{dt}$
11. The triple frequency of a six phase half wave rectifier for 220V, 60 Hz input will be 1 1 3 3  
 (A) 2160 Hz (B) 720 Hz  
 (C) 360 Hz (D) 60 Hz
12. The peak inverse current  $I_P$  for a power diode is given by the expression 1 1 3 3  
 (A)  $I_P = t + \frac{di}{dt}$  (B)  $I_P = t \times \log i$   
 (C)  $I_P = t \times \frac{di}{dt}$  (D)  $I_P = t + \int t \times i dt$
13. A single phase half wave circuit has  $V_s=230V$  with a load of  $100\Omega$ . Find the average load current at  $\alpha=30^\circ$ . 1 1 2 2  
 (A) 1.45A (B) 0.57A  
 (C) 0.96A (D) 2.3A
14. A fully controlled converter uses 1 1 3 3  
 (A) Diodes only (B) Thyristors only  
 (C) Both diodes and thyristors (D) None
15. A three phase three pulse converter would operate as a line commutated when 1 1 3 3  
 (A)  $30^\circ < \alpha < 60^\circ$  (B)  $90^\circ < \alpha < 180^\circ$   
 (C)  $90^\circ > \alpha$  (D)  $30^\circ > \alpha > 60^\circ$
16. In an inverter, if the fundamental frequency is 60 Hz, then the second lowest order harmonic will be 1 1 4 4  
 (A) 50 Hz (B) 100 Hz  
 (C) 200 Hz (D) 120 Hz
17. Calculate the phase voltage for a  $3\phi$   $180^\circ$  VSI if the value of DC supply is 20V 1 1 4 4  
 (A) 9.3V (B) 9.42V  
 (C) 9.18V (D) 9.78V
18. An inverter converts 1 1 4 4  
 (A) AC to AC (B) DC to DC  
 (C) AC to DC (D) DC to AC

19. Single phase half bridge inverters requires 1 1 4 4  
 (A) Two wires AC supply (B) Two wires DC supply  
 (C) Three wires AC supply (D) Three wires DC supply
20. \_\_\_\_\_ is the measure of the contribution of any individual harmonic to the inverter output voltage. 1 1 4 4  
 (A) THD (B) Distortion factor  
 (C) Harmonic factor (D) Ripple factor
21. A synchronous reluctance motor on over load runs as 1 1 5 5  
 (A) DC motor (B) Induction motor  
 (C) Hysteresis motor (D) None
22. To convert alternating into direct current in locomotives, a \_\_\_\_\_ may be used. 1 1 5 5  
 (A) Vibrating rectifier (B) Three phase bridge rectifier  
 (C) Synchronic rectifier (D) Voltage regulator
23. Three phase induction motors are widely used in electric-vehicles because of 1 1 5 5  
 (A) High efficiency (B) Good speed regulation  
 (C) Absence of the commutators (D) All the above
24. The power factor of an induction motor varies from around 0.85 at full load to about 0.20 at no load due to 1 1 5 5  
 (A) Stator and rotor leakage (B) Magnetizing reactance  
 (C) Both A and B (D) None
25.  $V/f$  is maintained constant in the following case of speed control of induction motor. 1 1 5 5  
 (A) Below base speed with voltage control (B) Below base speed with frequency control  
 (C) Above base speed with frequency control (D) Above rated speed with no load frequency control

### PART – B (5 × 10 = 50 Marks)

Answer ALL Questions

Marks BL CO PO

26. a. Explain in detail about construction, working principle and characteristics of BJT. 10 3 1 1
- (OR)
- b. Explain in detail about construction, working principle and characteristics of MOSFET. 10 4 1 1
27. a. Explain the construction and working of buck boost converter. 10 3 2 2
- (OR)
- b. What is duty cycle? Explain the mode of operation and output waveform of buck converter. 10 4 2 2