

**POWER ELECTRONICS & DRIVES**  
**(AEIE 3102)**

**Time Allotted : 2½ hrs**

**Full Marks : 60**

*Figures out of the right margin indicate full marks.*

*Candidates are required to answer Group A and any 4 (four) from Group B to E, taking one from each group.*

*Candidates are required to give answer in their own words as far as practicable.*

**Group – A**

1. Answer any twelve:

**12 × 1 = 12**

*Choose the correct alternative for the following*

- (i) Which device is a bidirectional switch?  
(a) TRIAC (b) IGBT  
(c) Power BJT (d) Power MOSFET.
- (ii) What is the function of a freewheeling diode in a controlled rectifier?  
(a) To control the input voltage (b) To allow reverse current flow  
(c) To improve power factor (d) To reduce harmonics.
- (iii) Which type of converter is used for power factor improvements?  
(a) Half-controlled converter (b) Fully controlled converter  
(c) Dual converter (d) Three-phase converter.
- (iv) What does PWM stand for in inverters?  
(a) Phase Width Modulation (b) Pulse Width Modulation  
(c) Power Wave Modulation (d) Phase Wave Modulation
- (v) What is the primary function of a chopper?  
(a) Convert DC to AC (b) Step up or step down DC voltage  
(c) Convert AC to DC (d) Voltage stabilization.
- (vi) What does CSI stand for in power electronics?  
(a) Current Source Inverter (b) Capacitor Source Inverter  
(c) Current Stabilization Inverter (d) Capacitor Stabilization Inverter.
- (vii) Which method is used for speed control of DC motors?  
(a) Stator voltage control (b) Rotor resistance control  
(c) Variable frequency control (d) Armature voltage control.
- (viii) What is the function of a Phase-Locked Loop (PLL) in DC drives?  
(a) Speed control (b) Frequency control  
(c) Phase control (d) Voltage regulation.

- (ix) What does V/f control mean in AC drives?  
 (a) Voltage/force control (b) Voltage/frequency control  
 (c) Variable/force control (d) Variable/frequency control.
- (x) What is the primary advantage of rotor resistance control in AC drives?  
 (a) Reduced cost (b) Improved efficiency  
 (c) Enhanced speed control (d) Lower power consumption.

*Fill in the blanks with the correct word*

- (xi) Power electronics essentially deals with control of a.c. power at \_\_\_\_\_ Hz frequency.
- (xii) The device that does not have the gate terminal is \_\_\_\_\_.
- (xiii) The V-I characteristics for a triac in the first and third quadrants are essentially identical to those of \_\_\_\_\_ in its first quadrant.
- (xiv) In a dual converter, the two converters operate in \_\_\_\_\_ directions.
- (xv) A \_\_\_\_\_ is a device used for bidirectional power flow.

### **Group - B**

2. (a) Define the static characteristics of an SCR. [[CO1](Remember/LOCQ)]  
 (b) Describe the dynamic turn-on switching characteristics of an SCR. [[CO1](Understand/IOCQ)]  
 (c) Compare SCR and Transistor in terms of their applications. [[CO1](Analyse/HOCQ)]  
**5 + 4 + 3 = 12**
3. (a) Explain the construction of IGBT with a diagram. [[CO1](Remember/LOCQ)]  
 (b) Describe the working of IGBT. [[CO1](Understand/IOCQ)]  
 (c) Discuss the advantages of using IGBT in power electronics. [[CO1](Evaluate/HOCQ)]  
**5 + 4 + 3 = 12**

### **Group - C**

4. (a) Explain the operation of a single-phase half-controlled rectifier. [[CO2](Remember/LOCQ)]  
 (b) Describe the impact of load type on the output characteristics of the rectifier. [[CO2](Understand/IOCQ)]  
 (c) Discuss the power factor of a single-phase half-controlled rectifier. [[CO2](Analyse/HOCQ)]  
**5 + 4 + 3 = 12**
5. (a) Explain the working of a three-phase fully-controlled rectifier. [[CO2,CO3](Remember/LOCQ)]  
 (b) Describe the harmonic factors in three-phase rectifiers. [[CO2,CO3](Understand/IOCQ)]  
 (c) Discuss the applications of three-phase rectifiers. [[CO2,CO3](Analyse/HOCQ)]  
**5 + 4 + 3 = 12**

## Group - D

6. (a) Explain the operation of a three-phase inverter in 180° mode. *[(CO4,CO6)(Remember/LOCQ)]*  
(b) Describe its output voltage control. *[(CO4,CO6)(Apply/IOCQ)]*  
(c) Discuss its use in motor drive applications. *[(CO4,CO6)(Evaluate/HOCQ)]*  
**5 + 4 + 3 = 12**
7. (a) Explain the role of buck converters in power electronics. *[(CO4,CO6)(Remember/LOCQ)]*  
(b) Describe the operation of boost converters. *[(CO4,CO6)(Apply/IOCQ)]*  
(c) Compare buck, boost, and buck-boost converters in terms of applications. *[(CO4,CO6)(Evaluate/HOCQ)]*  
**5 + 4 + 3 = 12**

## Group - E

8. (a) Explain the operation of single-phase separately excited drives. *[(CO5,CO6)(Remember/LOCQ)]*  
(b) Describe the braking operation of rectifier-controlled separately excited drives. *[(CO5,CO6)(Apply/IOCQ)]*  
(c) Discuss their industrial applications. *[(CO5,CO6)(Analyse/HOCQ)]*  
**5 + 4 + 3 = 12**
9. (a) Explain the Slip Power Recovery Scheme in AC drives. *[(CO5)(Remember/LOCQ)]*  
(b) Describe its application in variable speed drives. *[(CO5)(Apply/IOCQ)]*  
(c) Compare its advantages and disadvantages. *[(CO5)(Evaluate/HOCQ)]*  
**5 + 4 + 3 = 12**

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Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	41.67	33.33	25

