| Reg. No. | | | | | | | | | | | | | | | |
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| Question Paper Code | 13452 |
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**B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2025**

Sixth Semester

**Electronics and Instrumentation Engineering**

**20EIPC603 - POWER ELECTRONICS DRIVES AND CONTROL**

Regulations - 2020

Duration: 3 Hours | Max. Marks: 100

**PART - A (MCQ) (10 × 1 = 10 Marks)**

Answer ALL Questions

| | | Marks | K – Level | CO |
|---|---|---|---|---|
| 1. | Limitation of a Bipolar Junction Transistor (BJT) in power applications is:<br>(a) Low switching speed (b) High gate drive power requirement<br>(c) High forward voltage drop (d) Difficulty in integration with integrated circuits | 1 | K1 | CO1 |
| 2. | A Silicon-Controlled Rectifier (SCR) is a type of:<br>(a) Unidirectional switch (b) Bidirectional switch<br>(c) Power diode (d) Bipolar junction transistor | 1 | K1 | CO1 |
| 3. | In a single-phase half-wave controlled rectifier, the output DC voltage depends on the:<br>(a) Load current (b) Input AC voltage and firing angle<br>(c) Frequency of the AC supply (d) Type of rectifier used | 1 | K1 | CO2 |
| 4. | In a thyristor-based rectifier, increased source inductance leads to:<br>(a) Shorter commutation period (b) Higher efficiency<br>(c) Lower power factor (d) Higher output voltage | 1 | K1 | CO2 |
| 5. | Type of DC to DC converter provides electrical isolation between input and output?<br>(a) Buck converter (b) Boost converter<br>(c) Fly back converter (d) Buck-boost converter | 1 | K1 | CO3 |
| 6. | The device is commonly used as the switching element in a DC-DC converter?<br>(a) Diode (b) MOSFET (c) Transformer (d) Resistor | 1 | K1 | CO3 |
| 7. | The main disadvantage of a square wave inverter?<br>(a) High cost (b) Complex circuitry (c) High harmonic distortion (d) Large size | 1 | K1 | CO4 |
| 8. | Type of inverter is most suitable for industrial motor drives?<br>(a) Square wave inverter (b) Pure sine wave inverter<br>(c) Current source inverter (d) Voltage source inverter | 1 | K1 | CO4 |
| 9. | The following is NOT a component of an electric drive system?<br>(a) Power modulator (b) Motor (c) Controller (d) Alternator | 1 | K1 | CO5 |
| 10. | The drive best suited for applications requiring frequent starting, stopping, and reversing?<br>(a) AC drive (b) DC drive (c) Stepper drive (d) Servo drive | 1 | K1 | CO5 |

**PART - B (12 × 2 = 24 Marks)**

Answer ALL Questions

| | | Marks | K – Level | CO |
|---|---|---|---|---|
| 11. | Define the term pinch off voltage of MOSFET. | 2 | K1 | CO1 |
| 12. | Power BJT is a current controlled device. Why? | 2 | K1 | CO1 |
| 13. | Distinguish between SCR and TRIAC. | 2 | K2 | CO1 |
| 14. | What is meant continuous current operation of thyristor converter? | 2 | K1 | CO2 |
| 15. | Illustrate the PIV of a thyristors. | 2 | K2 | CO2 |
| 16. | Summarize the roles of freewheeling diode in a Full converter. | 2 | K2 | CO2 |
| 17. | Mention any two applications of SMPS. | 2 | K1 | CO3 |
| 18. | What is resonant converter? States its advantages. | 2 | K1 | CO3 |
| 19. | Recite the merits and demerits of CSI. | 2 | K1 | CO4 |
| 20. | Judge thyristors are not preferred for Inverter. | 2 | K2 | CO4 |
| 21. | Illustrate static Ward-Leonard drive. | 2 | K2 | CO5 |
| 22. | What is meant by slip power recovery scheme? | 2 | K1 | CO5 |

**PART - C (6 × 11 = 66 Marks)**

Answer ALL Questions

| | | | | | |
|---|---|---|---|---|---|
| 23. | a) | With neat sketch explain the turn on and turn off characteristic of SCR. | *11* | *K2* | *CO1* |
| | | **OR** | | | |
| | b) | Describe with neat sketch working and characteristics of IGBT. | *11* | *K2* | *CO1* |
| 24. | a) | The full-wave three-phase controlled rectifier has a three phase 415V, 50Hz source (240V Phase), and provides 100A constant load current. Determine:<br>(i) The average and rms thyristor current.<br>(ii)The rms and fundamental line current.<br>The fundamental apparent power. | *11* | *K3* | *CO2* |
| | | **OR** | | | |
| | b) | A single-phase half wave rectifier with an AC voltage of 150V has a pure resistive load of 9Ω. The firing angle of the thyristor is π/2. Determine the<br>(i) Rectification Efficiency<br>(ii) Form Factor<br>(iii) Peak inverse voltage of the SCR | *11* | *K3* | *CO2* |
| 25. | a) | With neat diagrams, describe the construction and working of step-up chopper and its steady state analysis. Also, give its application. | *11* | *K2* | *CO3* |
| | | **OR** | | | |
| | b) | Draw and explain the block schematic of SMPS and mention its advantages over linear power supply. | *11* | *K2* | *CO3* |
| 26. | a) | Discover the operation of 3 phase bridge inverter for 180-degree mode of operation with aid of relevant phase and line voltage wave forms. | *11* | *K2* | *CO4* |
| | | **OR** | | | |
| | b) | Establish the Principle of operation of single phase CSI with power circuit. Draw the equivalent circuits and relevant waveforms. | *11* | *K2* | *CO4* |
| 27. | a) | Discuss in detail Rectifier based Electric Breaking. | *11* | *K2* | *CO5* |
| | | **OR** | | | |
| | b) | Generalize the operation of Chopper controlled DC drives. | *11* | *K2* | *CO5* |
| 28. | a) (i) | What is PWM? List the various PWM techniques and explain any two of them. | *6* | *K2* | *CO4* |
| | (ii) | Explain the operation of V/f controlled AC Drives. | *5* | *K2* | *CO5* |
| | | **OR** | | | |
| | b) (i) | Compare ZVS with ZCS. | *6* | *K2* | *CO4* |
| | (ii) | Discuss briefly Vector control method of AC Drives. | *5* | *K2* | *CO5* |