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BRAINWARE UNIVERSITY

Term End Examination 2025-2026

Programme – Dip.RA-2023

Course Name – Industrial Electronics

Course Code - ECPC601

(Semester VI)

Full Marks : 60

Time : 2:30 Hours

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group-A

(Multiple Choice Type Question)

1 x 15=15

1. Choose the correct alternative from the following :

- (i) Select the role of a diode in a buck converter circuit.
 - a) Blocks input voltage
 - b) Acts as a freewheeling diode
 - c) Provides isolation
 - d) Reduces switching losses
- (ii) Indicate the major drawback of a boost converter.
 - a) Low efficiency
 - b) Requires complex control
 - c) No voltage step-up
 - d) High voltage ripple
- (iii) Develop the method is used to ensure voltage sharing in series-connected diodes.
 - a) Heat sinks
 - b) Equalizing resistors
 - c) Inductors
 - d) Zener diodes
- (iv) Indicate which factor primarily affects the output ripple of an SMPS.
 - a) Switching frequency
 - b) Transformer size
 - c) Linear regulator used
 - d) None
- (v) Define the thermal resistance of a diode can be reduced by.
 - a) Increasing ambient temperature
 - b) Using a heat sink
 - c) Reducing forward voltage drop
 - d) Increasing the reverse voltage rating
- (vi) Discuss the forward voltage drop of a silicon power diode is approximately.
 - a) 0.2V
 - b) 0.7V
 - c) 1.1V
 - d) 3.5V
- (vii) Choose the primary factor that determines the switching frequency of an SMPS.
 - a) Inductor size
 - b) Control circuit design
 - c) Input voltage
 - d) All of the above
- (viii) Discuss the process of reducing the recovery time of a diode by recombination of carriers is called.
 - a) Soft switching
 - b) Charge removal
 - c) Reverse biasing
 - d) Snubber circuiting

- (ix) Explain the reverse recovery time of a power diode is measured between.
- 10% to 90% of reverse recovery current
 - 0% to 90% of reverse recovery current
 - 90% to 10% of reverse recovery current
 - 100% to 0% of reverse recovery current
- (x) Define a vertical power transistor.
- A transistor with lateral current flow
 - A transistor with vertical current flow
 - A transistor without a base terminal
 - A transistor used only in digital circuits
- (xi) Discuss the significance of the safe operating area (SOA) in power BJTs.
- To determine the speed of the device
 - To prevent excessive voltage and current stress
 - To increase the switching losses
 - To improve the switching speed
- (xii) Discuss why Darlington configuration is used in power BJTs.
- To reduce current gain
 - To increase current gain
 - To increase power dissipation
 - To decrease output current
- (xiii) Explain the components of a snubber circuit.
- Inductor and resistor
 - Capacitor and resistor
 - Transformer and diode
 - Transistor and inductor
- (xiv) Indicate why a heat sink is required in a linear regulator but not in a switching regulator.
- Switching regulators generate less heat
 - Switching regulators have low efficiency
 - Switching regulators use resistive dissipation
 - None
- (xv) Identify the main component responsible for voltage regulation in an SMPS.
- Zener diode
 - Switching transistor
 - Op-amp
 - Capacitor

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Group-B
(Short Answer Type Questions)

3 x 5=15

- Define the Darlington configuration of power BJTs. (3)
- Explain the construction of an Insulated Gate Bipolar Transistor (IGBT). (3)
- Explain the principle of operation of a Switching Mode Power Supply (SMPS). (3)
- Explain the working principle of a single-phase half-wave and full-wave controlled rectifier with resistive and inductive loads. (3)
- Illustrate the operating principle of a power MOSFET. (3)

OR

- Explain the switching characteristics of power diodes. (3)

Group-C
(Long Answer Type Questions)

5 x 6=30

- Discuss the thermal characteristics of power diodes. (5)
- Describe the principle of operation of a power transistor. (5)
- Illustrate the Darlington configuration in power BJTs. Explain its advantages. (5)
- Define block diagram voltage regulation. (5)
- Explain the working of a PWM control circuit in an SMPS. (5)
- Conclude does thermal runaway occur in power diodes. (5)

OR

- Explain the structure of a vertical power transistor and its advantages. (5)
