BRAINWARE UNIVERSITY

Term End Examination 2024-2025
Programme – Dip.RA-2022
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) Choose the reason why switching regulators are preferred over linear regulators in power-sensitive applications

a) Higher power dissipation b) Lower efficiency
c) High efficiency and low heat d) Expensive and large size

(ii) 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

(iii) Indicate the major drawback of a boost converter.

a) Low efficiency b) Requires complex control
c) No voltage step-up d) High voltage ripple

(iv) Identify the key difference between a buck and a boost converter.

a) Buck steps down voltage, boost steps up b) Both step up voltage
c) Both step down voltage d) None

(v) Select the main reason for using a buck-boost converter.

a) Only steps up voltage b) Can step up or down voltage
c) Provides positive output only d) None

(vi) Define the diode is operating at a high frequency. Which parameter is most critical?

a) Reverse recovery time b) Forward voltage drop
c) Thermal resistance d) Breakdown voltage

(vii) 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

(viii) Discuss the power diodes are generally made of.

a) Silicon b) Germanium
c) Gallium arsenide d) Copper

(ix) Discuss the forward voltage drop of a silicon power diode is approximately.

a) 0.2V b) 0.7V
c) 1.1V d) 3.5V

(x) 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

(xi) Explain the reverse recovery time of a power diode is measured between.

a) 10% to 90% of reverse recovery current b) 0% to 90% of reverse recovery current
c) 90% to 10% of reverse recovery current d) 100% to 0% of reverse recovery current

(xii) Explain the working principle of a power BJT.

a) Conducts current only through the emitter b) Uses minority carriers for conduction
c) Uses majority carriers for conduction d) Operates in depletion mode only

(xiii) Indicate the correct switching characteristic of an IGBT.

a) Fast turn-on, slow turn-off b) Slow turn-on, fast turn-off
c) Slow turn-on, slow turn-off d) Fast turn-on, fast turn-off

(xiv) Choose the correct operating principle of an IGBT.

a) Voltage-controlled device b) Current-controlled device
c) Resistance-controlled device d) Temperature-dependent device

(xv) Select the correct type of losses in power semiconductor devices.

a) Conduction and switching losses b) Conduction loss only
c) Switching loss only d) Leakage loss only

Group-B

(Short Answer Type Questions) 3 x 5=15

2. Explain the principle of operation of a Switching Mode Power Supply (SMPS). (3)
3. Define the function of a PWM control circuit in a switching regulator. (3)
4. Explain the working principle of a single-phase half-wave and full-wave controlled rectifier with resistive and inductive loads. (3)
5. Define the role of a freewheeling diode in controlled rectifiers. (3)
6. Illustrate the calculation of Vdc, Vrms, ripple factor, PIV, and efficiency in controlled rectifiers. (3)

OR

Illustrate the family of thyristor devices including Photo-SCR, GTO, SCS, TRIAC, and DIAC. (3)

Group-C

(Long Answer Type Questions) 5 x 6=30

7. Discuss the thermal characteristics of power diodes. (5)
8. Define a snubber circuit. Explain its function in protecting power semiconductor devices. (5)
9. Explain the working principle of a single-phase half-wave controlled rectifier with a resistive load. (5)
10. Explain the working of a three-phase half-wave controlled rectifier. (5)
11. Choose the application where a boost converter is used. (5)
12. Explain the operation of an isolated SMPS. (5)

OR

Explain the role of feedback in SMPS circuits. (5)

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