

GURU NANAK INSTITUTE OF TECHNOLOGY
An Autonomous Institute under MAKAUT
2020-2021
ADVANCE POWER ELECTRONICS
EE702B

TIME ALLOTTED: 3 HOURS

FULL MARKS: 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable

GROUP – A

(Multiple Choice Type Questions)

Answer any *ten* from the following, choosing the correct alternative of each question: **10×1=10**

| | Marks | CO No |
|--|--------------|--------------|
| (i) In a flyback converter, the inductor of the buck-boost converter has been replaced by a (a) Flyback Capacitor (b) Flyback Resistor (c) Flyback Transformer (d) Flyback transistor | 1 | CO1 |
| (ii) Why do we have to use Multilevel Inverter? (a) To overcome device rating limitation (b) For higher power application (c) It produces output with less harmonic content (d) All of these | 1 | CO1 |
| (iii) The output voltage of a flyback circuit is $V_o=24V$ with a resistive load of $R=0.8\Omega$. The duty ratio $k=50\%$ and the switching frequency $f=1kHz$. The on state voltage drops of transistors and diodes are $V_t=1.2V$ and $V_d=0.7V$ respectively. The turn ratio of the transformer $N_s/N_p=0.25$. The input voltage (in V) is (a) 100V (b) 25V (c) 83.33V (d) 30V | 1 | CO1 |
| (iv) Do we need to design a filter for 5 th order harmonic of 6-pulse converter (a) Yes (b) No (c) May be (d) Partially yes | 1 | CO1 |
| (v) Disadvantage with series compensation (a) Reduce the stability (b) Increase the voltage drop (c) Reduce the power factor (d) Increase in fault current | 1 | CO3 |

- | | | | |
|--------|---|---|-----|
| (vi) | For a 3 level diode clamped multilevel inverter, how many IGBT's are required to produce complete cycle waveform (a) 4 (b) 6 (c) 8 (d) 10 | 1 | CO2 |
| (vii) | The current leads supply voltage if a series resonant circuit exhibits its operation_____ the resonant frequency (a) Above (b) Below (c) Equal to (d) None of the above | 1 | CO2 |
| (viii) | Harmonic content of Multilevel Inverter output is _____ the output of Voltage Source Inverter. (a) less than (b) zero (c) greater than (d) same as | 1 | CO2 |
| (ix) | To achieve ZVS operation of a semiconductor switch, the switch must be connected to a (a) Inductor in series (b) Inductor in parallel (c) Capacitor in series (d) Capacitor in parallel | 1 | CO2 |
| (x) | Current mode control method uses (a) One loop (b) Two loops (c) Three loops (d) None of these | 1 | CO2 |
| (xi) | Cascaded H bridge inverters use (a) Single voltage source (b) Separate voltage sources (c) Both (a) & (b) (d) None of these | 1 | CO2 |
| (xii) | Cuk converter is better than buck converter in terms of output voltage (a) True (b) False (c) Partially true (d) Partially false | 1 | CO1 |

GROUP – B

(Short Answer Type Questions)

Answer any *three* from the following: **3×5=15**

- | | | Marks | CO No |
|----|---|--------------|--------------|
| 2. | What are the advantage and disadvantage of resonant inverter with bidirectional switches? | 5 | CO1 |
| 3. | What are the elements of SMPS? Discuss the operation of switched mode DC power supplies. | 5 | CO1 |

| | | | |
|----|---|---|-----|
| 4. | Explain diode clamped 3-level inverter configuration | 5 | CO3 |
| 5. | Draw schematic diagram of TSC. Explain how this device improves performance of transmission line. | 5 | CO3 |
| 6. | Draw and Describe Very briefly (i) Two Transistor Flyback Converter (ii) Paralleling Flyback Converter. | 5 | CO1 |

GROUP – C

(Long Answer Type Questions)

Answer any *three* from the following: **3×15=45**

| | | Marks | CO No |
|-----|--|--------------|--------------|
| 7. | (a) How Multilevel Inverter differ from two level inverter? Mention different topologies used in Multilevel Inverter. | 4 | CO2 |
| | (b) Multilevel Inverter is mostly applied in medium and high voltage application. Explain. | 2 | CO2 |
| | (c) Mention advantages of Multilevel Inverter. | 6 | CO2 |
| | (d) Mention different application of Multilevel Inverter. | 3 | CO2 |
| 8. | (a) Describe Forward Converter with proper circuit diagram and waveform. | 10 | CO1 |
| | (b) A sepic converter having the following parameters, $V_s = 9$ volt, $D = 0.4$, $f = 100$ kHz, $L_1 = L_2 = 90$ μ H, $C_1 = C_2 = 80$ μ F, $I_o = 2$ amp. Determine output voltage, average maximum and minimum inductor current and variation in voltage across in each capacitor. | 5 | CO1 |
| 9. | (a) Define FACTS. Give details classification of FACTS controller | 05 | CO2 |
| | (b) Explain the working of FC-TCR. Draw neat diagram. | 05 | CO2 |
| | (c) Compare the V-I characteristics of STATCOM and SVC | 05 | CO2 |
| 10. | (a) With neat circuit diagram and waveform discuss class-E resonant inverter? | 07 | CO2 |
| | (b) Explain the principle of L-type ZCS resonant inverter with circuit diagram and waveform. | 08 | CO2 |
| 11. | Write short notes on: (Any three) | 3×5 | |
| | (a) TSC | 5 | CO3 |
| | (b) FC-TCR | 5 | CO3 |
| | (c) TCR | 5 | CO3 |
| | (d) TSR | 5 | CO3 |