UNIVERSITY COLLEGE
TATI

UNIVERSITY COLLEGE TATI (UC TATI)

FINAL EXAMINATION QUESTION BOOKLET

COURSE CODE	: BET 3013
COURSE	: POWER ELECTRONIC
SEMESTER/SESSION	: 2-2024/2025
DURATION	: 3 HOURS

Instructions:

1. This booklet contains 4 questions. Answer **all** questions.

2. All answers should be written in answer booklet.

3. Write legibly and draw sketches wherever required.

4. If in doubt, raise your hands and ask the invigilator.

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO

THIS BOOKLET CONTAINS <u>6</u> PRINTED PAGES INCLUDING COVER PAGE
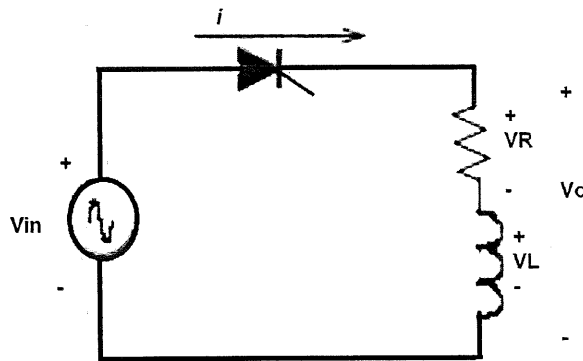
POWER ELECTRONIC (BET 3013)

QUESTION 1

a) Explain the concept of power electronic circuit   (3 marks)

b) State two (2) types of losses in semiconductor devices.   (2 marks)

c) Explain how switching operation method used in converter circuit able to reduce the losses compared to other method.   (5 marks)

d) Explain two (2) types of solar power.   (4 marks)

e) A building has the following electrical appliance usage:
   - 2 x 15 Watt fluorescent lamp with electronic ballast (used for 6 hours per day)
   - 1 x 55 Watt fan (used for 4 hours per day)
   - 1 x45 Watt refrigerator (runs 24 hours per day, compressor: 12 hours ON, 12 hours OFF).
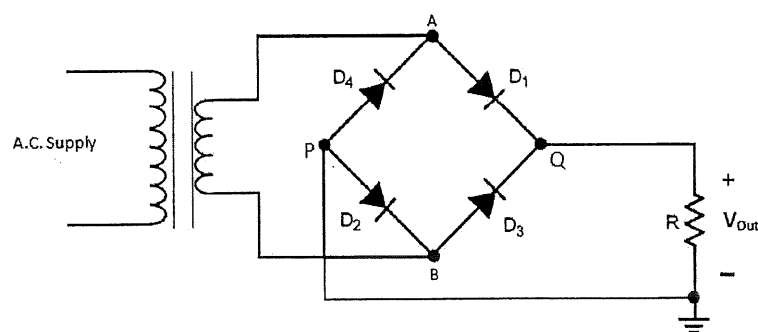   - The system will be powered by 12 Vdc, 110 Wp PV module.

Calculate the total of PV module need to produce load demand in this building. (6 marks)

QUESTION 2

a) Explain switching devices used in controlled and uncontrolled rectifier (4 marks)

b) Figure 1 shows one type of uncontrolled rectifier, refer to it and :

   i. Produce the waveforms of V_{out} and I_{out} (4 marks)

   ii. Explain the operation of the rectifier. (6 marks)

   iii. Produce the waveform of the rectifier as the freewheeling diode is added parallel with the output. (4 marks)

   iv. Describe the function of freewheeling diode (2 marks)

Figure 1

c) Figure 2 shows the circuit of uncontrolled rectifier. Refer to it and explain the operation of the circuit. (6 marks)

Figure 2

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d) Refer to the output waveform in Figure 3 :

   i. Classify the rectifier mode of operation. (1 mark)

   ii. Prove your answer in (i) by using mathematical method where : (3 marks)

      $\alpha=90°$, $f=50Hz$, $L=200mH$ and $R=10\Omega$

Vo

Figure 3

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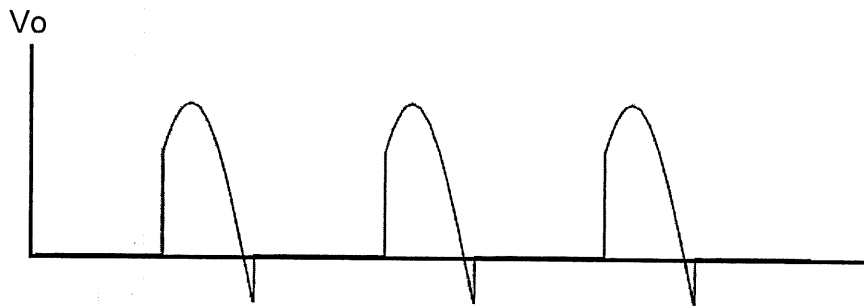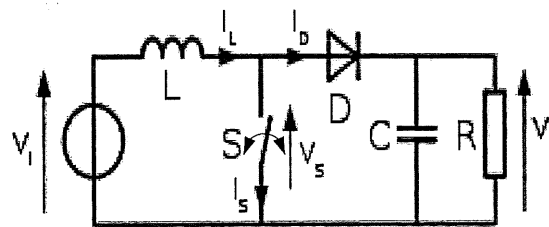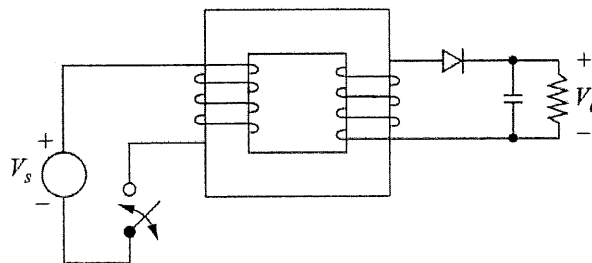## QUESTION 3

a) Differentiate non isolated and isolated DC chopper   (4 marks)

b) Figure 4 shows one of the non isolated DC chopper circuit. Refer to it and :

    i.   Describe the function of the circuit   (2 marks)

    ii. Explain operation of the circuit during ON and OFF switching state complete with the circuit diagram.   (10 marks)

    iii. Calculate the value of V_{out} from 50V battery source as given $C=100\mu F, L=400\mu H, R=20\Omega, fs=20kHz$ and $D=0.4$ (2 marks)
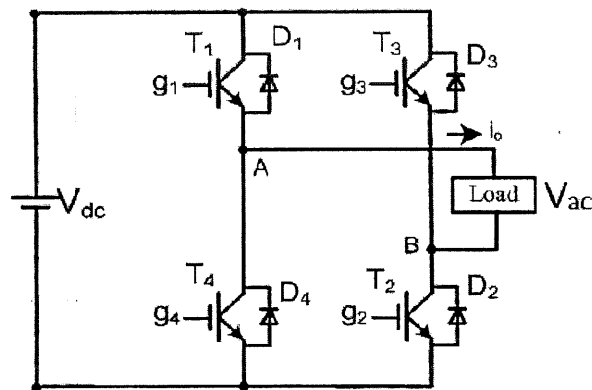

Figure 4

c) Figure 5 shows one of the Flyback DC chopper circuit. Refer to it and explain the :

    i.   Function of the Flyback converter.   (2 marks)

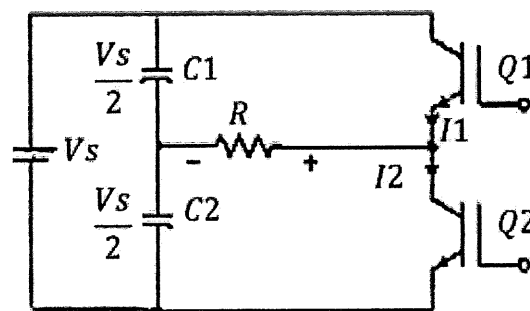   ii. Operation of the Flyback converter complete with the diagram.   (10 marks)

Figure 5

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QUESTION 4

a) Explain electrical inverter. (2 marks)

b) Refer to Figure 6, explain operation of the full bridge inverter circuit with R load using square wave switching scheme. (6 marks)

Figure 6

c) Referring to Figure 7:

   i. Produce the waveform of voltage and current output. (4 marks)

   ii. Explain the operation of the circuit (6 marks)

   iii. Calculate the value of V_{out} from 50V battery source. (2 marks)

Figure 7

---End of question---