

**UNIVERSITY COLLEGE TATI (UC TATI)****FINAL EXAMINATION QUESTION BOOKLET**

COURSE CODE	: BMT 3063
COURSE	: POWER ELECTRONICS AND DRIVE
SEMESTER/SESSION	: 1-2023/2024
DURATION	: 3 HOURS

Instructions:

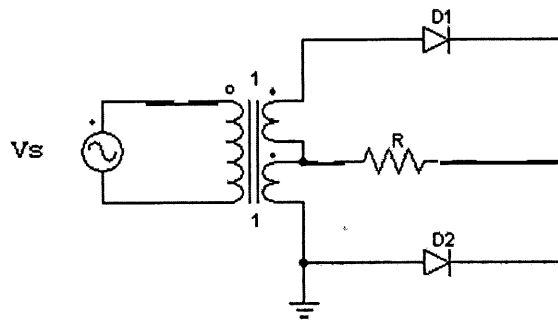
1. This booklet contains 4 questions. Answer **all** questions.
2. All answers should be written in answer booklet.
3. Write legibly and draw sketches wherever required.
4. If in doubt, raise your hands and ask the invigilator.

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

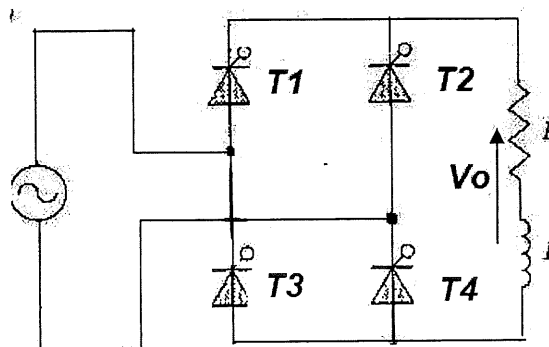
THIS BOOKLET CONTAINS 6 PRINTED PAGES INCLUDING COVER PAGE

QUESTION 1

- a) Define rectifier. (3 marks)
- b) Describe the main different between full wave and half wave rectifier. (2 marks)
- c) Figure 1 shows circuit of uncontrolled rectifier. Explain the operation of the circuit. (6 marks)

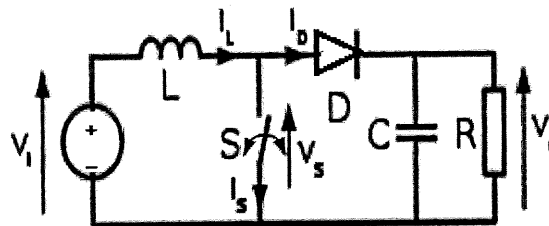
**Figure 1**

- d) Figure 2 shows a type of controlled rectifier with value of $\alpha = 45^\circ$, $f=50\text{Hz}$, $L=200\text{mH}$ and $R=10\Omega$. By refer to the circuit :
- Produce the waveforms of V_{out} and I_{out} . (4 marks)
 - Explain the operation of the rectifier. (6 marks)
 - Produce the waveform of V_{out} and I_{out} as the $\alpha = 90^\circ$. (4 marks)
 - State the mode of operation for the circuit when α changed to 90° . (2 marks)

**Figure 2**

QUESTION 2

- a) State two (2) type of non isolated DC chopper with the example. (4 marks)
- b) Figure 3 shows the DC chopper circuit.
- State the function of the circuit. (2 marks)
 - Explain the operation of the circuit during ON and OFF switching state complete with the circuit diagram. (10 marks)
 - Calculate the value of V_{out} from 25V battery source as given (2 marks)
 $C=100\mu F, L=400\mu H, R=20\Omega, f_s=20kHz$ and $D=0.6$

**Figure 3**

QUESTION 3

a) Refer to Figure 4:

- i. State the type of the inverter (2 marks)
- ii. Explain the operation of the inverter circuit with R load (6 marks)

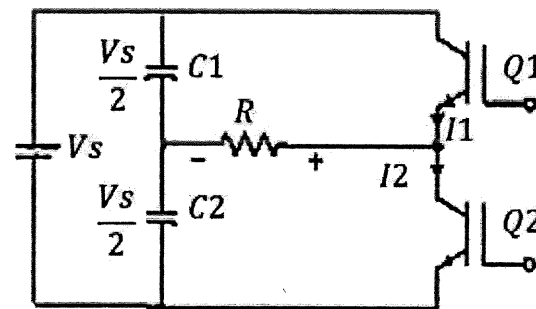


Figure 4

b) Refer to Figure 5:

- i. Produce the waveform of voltage and current output for $V_s = 50V$ and $R = 1\Omega$ (4 marks)
- ii. Explain the operation of the circuit (4 marks)
- iii. Calculate the value of V_{out} from 70V battery source. (2 marks)

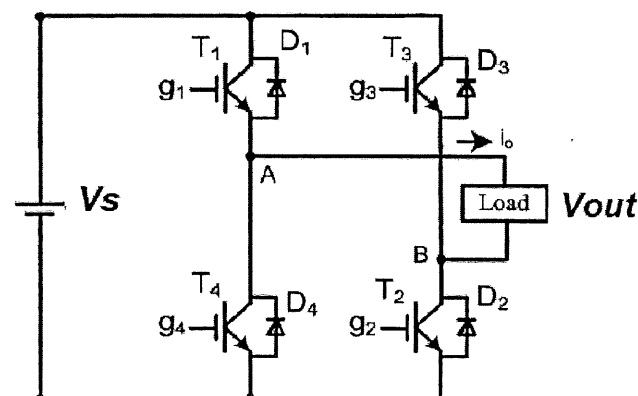
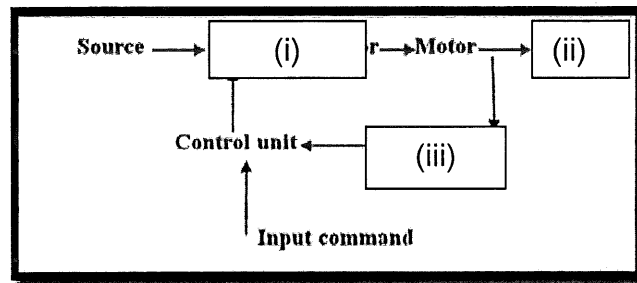


Figure 5

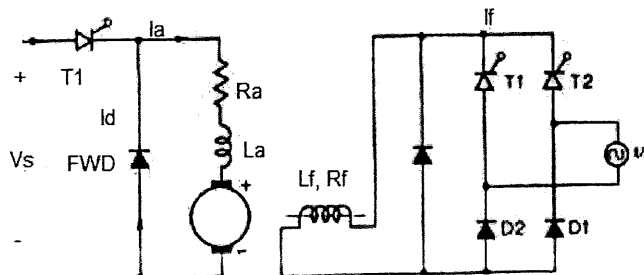
QUESTION 4

- a) Complete the block diagram of electrical drives in Figure 6. (3 marks)

**Figure 6**

- b) Explain two(2) methods to control the speed of series dc motor. (4 marks)
- c) Figure 7 shows the dc motor fed by single phase controlled rectifier. Given the emf is 4V and the armature resistance is 10 ohm. Gate current supply to the single phase rectifier at the armature in delay of 45 degree and the V_{max} is 339.41V. For the field side, the single phase semi conductor have delay angle of 60 degree, field resistance of 5 ohm and V_{max} of 339.41V. Calculate :

- Armature voltage, V_a . (3 marks)
- Armature current, I_a . (2 marks)
- Armature voltage, V_a if the firing angle increase to 60 degree. (3 marks)
- Field voltage, V_f of the single phase semiconductor. (4 marks)

**Figure 7**

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- d) Explain operation of Variable Frequency Drives (VFD) in controlling speed of induction motor above the base speed. (7 marks)
- e) Variable voltage and constant frequency is the method used in induction motor drive by using thyristors.
- i. Draw the circuit of the above mentioned method. (4 marks)
 - ii. Explain the operation of the circuit in (i) to drive induction motor. (7 marks)

-----End of question-----